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NATIONALGEOGRAPHIC.COM/MAGAZINE | JUNE 2008

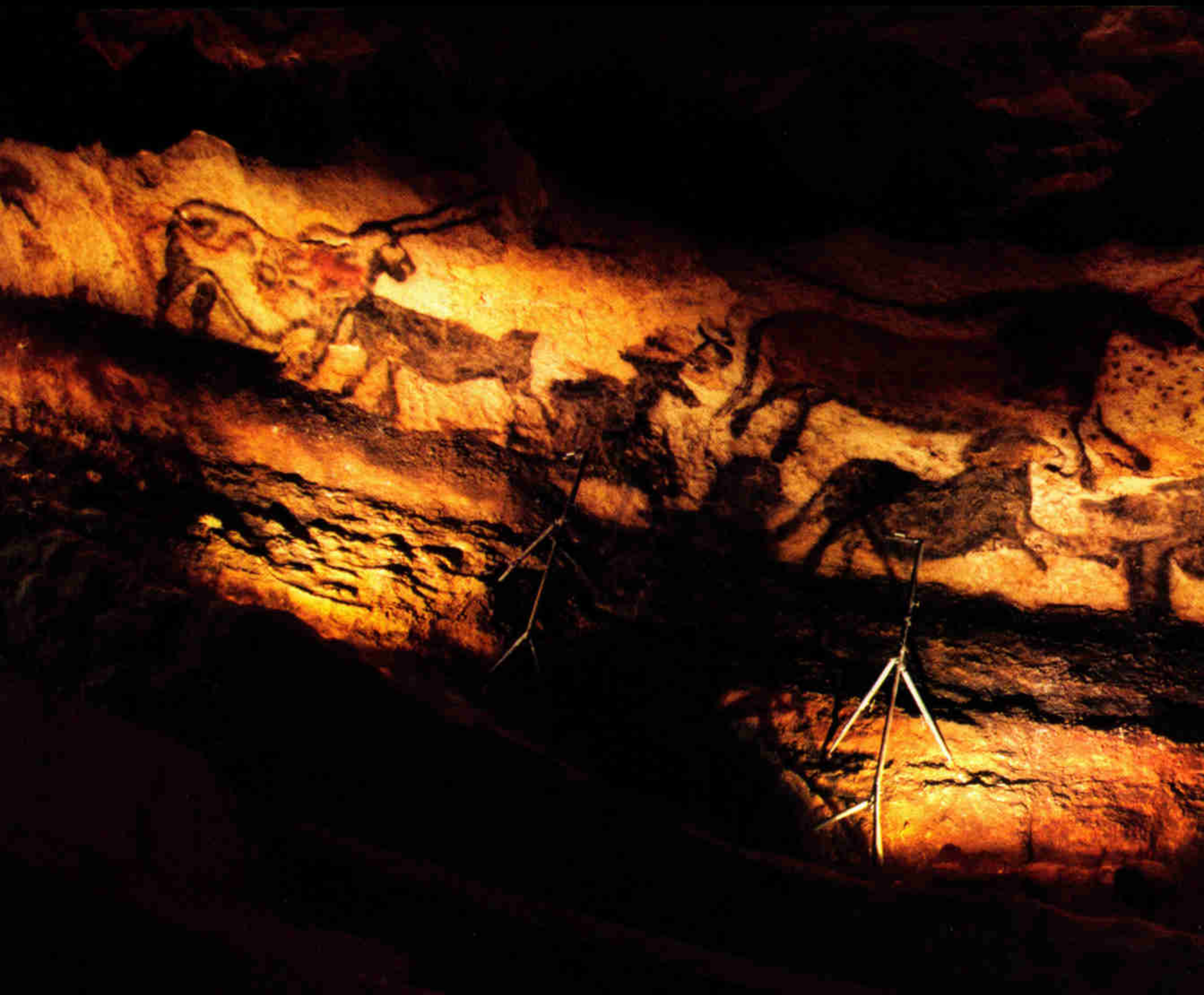
# NATIONAL GEOGRAPHIC

## SECRETS OF Stonehenge

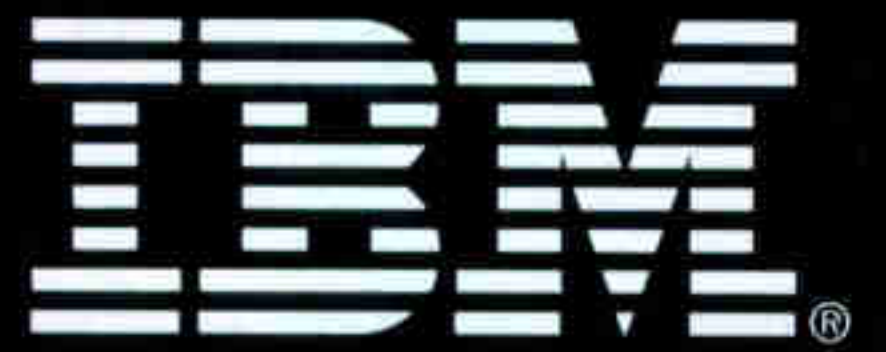
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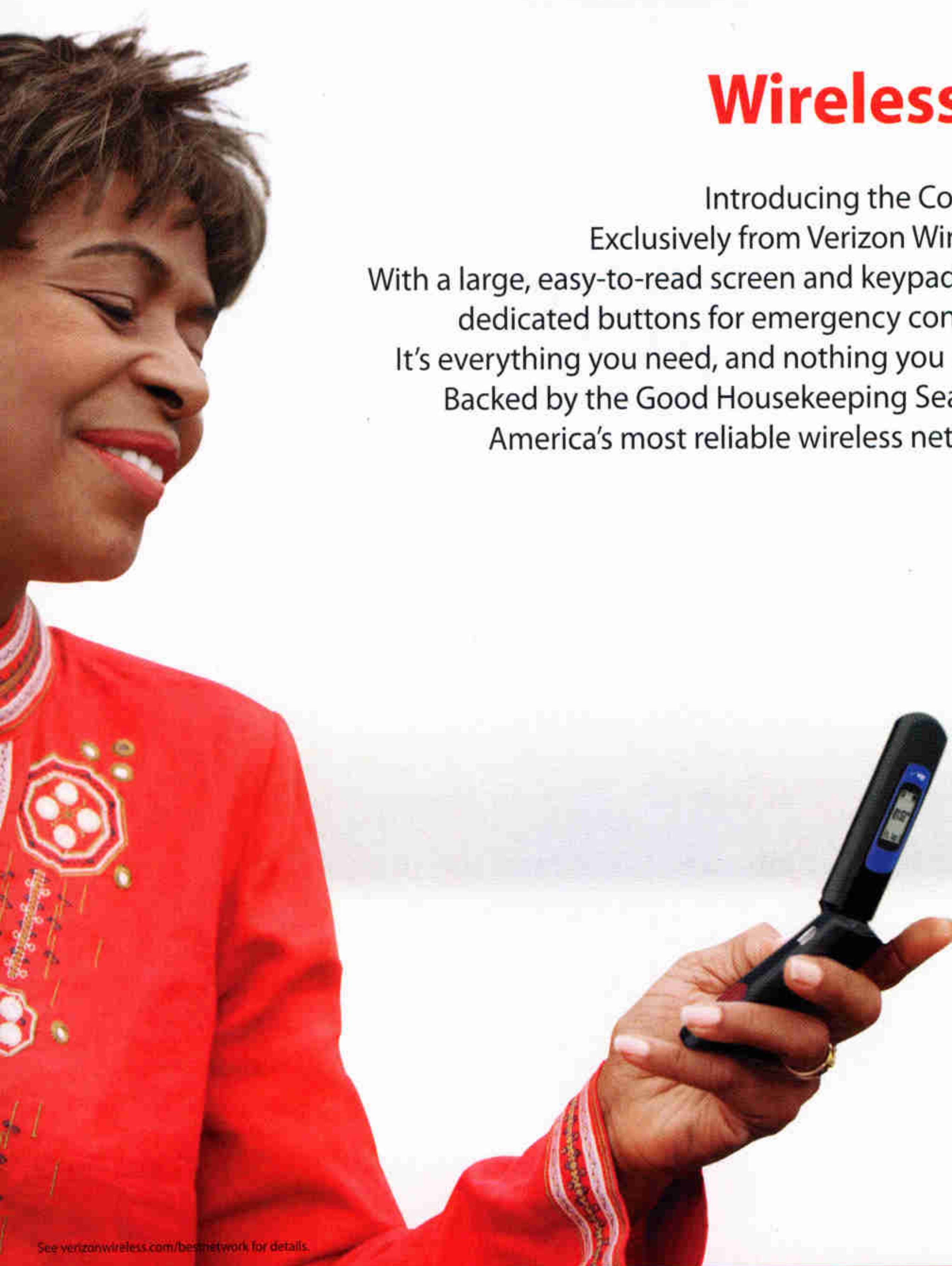




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# NATIONAL GEOGRAPHIC

JUNE 2008 • VOL. 213 • NO. 6

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*By Caroline Alexander Photographs by Ken Geiger*
- Frozen Assets** **60** Awash in oil wealth, Siberia goes upscale.  
*By Paul Starobin Photographs by Gerd Ludwig*
- World Oil** **86** Supplies are faltering while demand surges.  
*By Paul Roberts*
- Living Color** **92** Humble sea slugs turn self-defense into art.  
*By Jennifer S. Holland Photographs by David Doubilet*
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*By Douglas H. Chadwick Photographs by Steve Winter*
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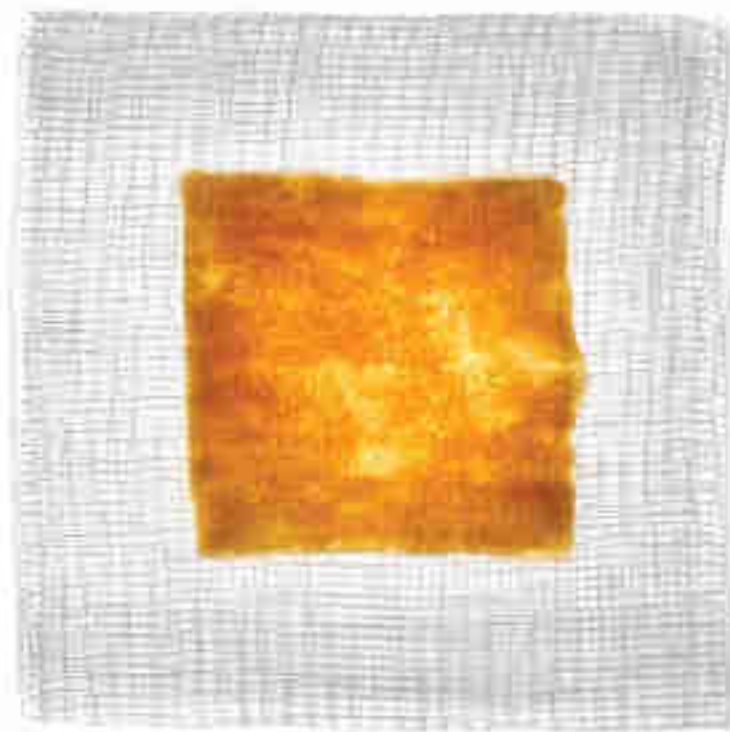


CHROMODORIS SP.  
STORY ON PAGE 92  
PHOTO: DAVID DOUBILET

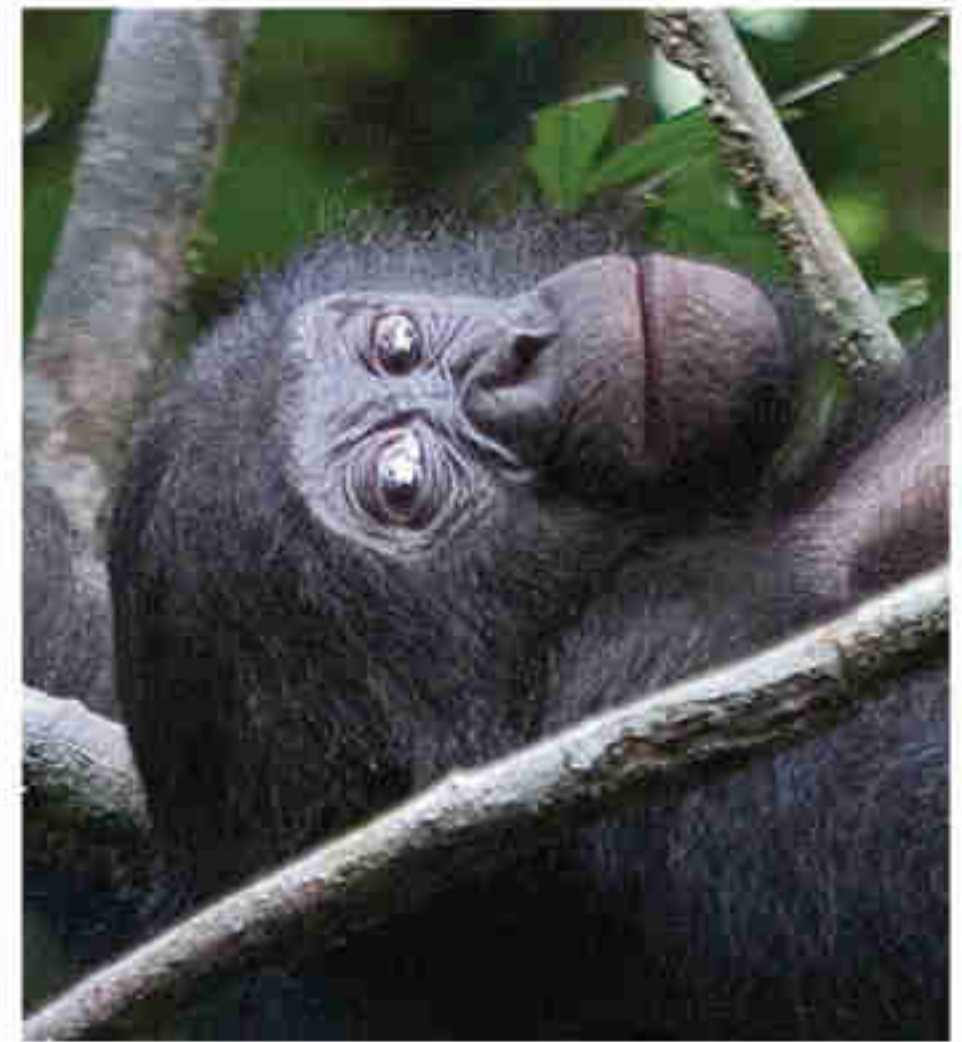




Arctic Ocean



Honey's Healing Power



A Boon for Bonobos

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## On the Web

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### ✦ Taking Stock of British Rocks

Try our Stonehenge quiz to see if you know the real story behind the mysterious slabs.

### ✦ All Over the Map

Our Map of the Day marks notable moments, then and now: Ft. Sumter surrenders, the Burma Road is reopened, a man golfs on the moon.

## On the Cover

The majesty and mystery of Stonehenge still beckon.

*Photo by Ken Geiger, NG Staff*

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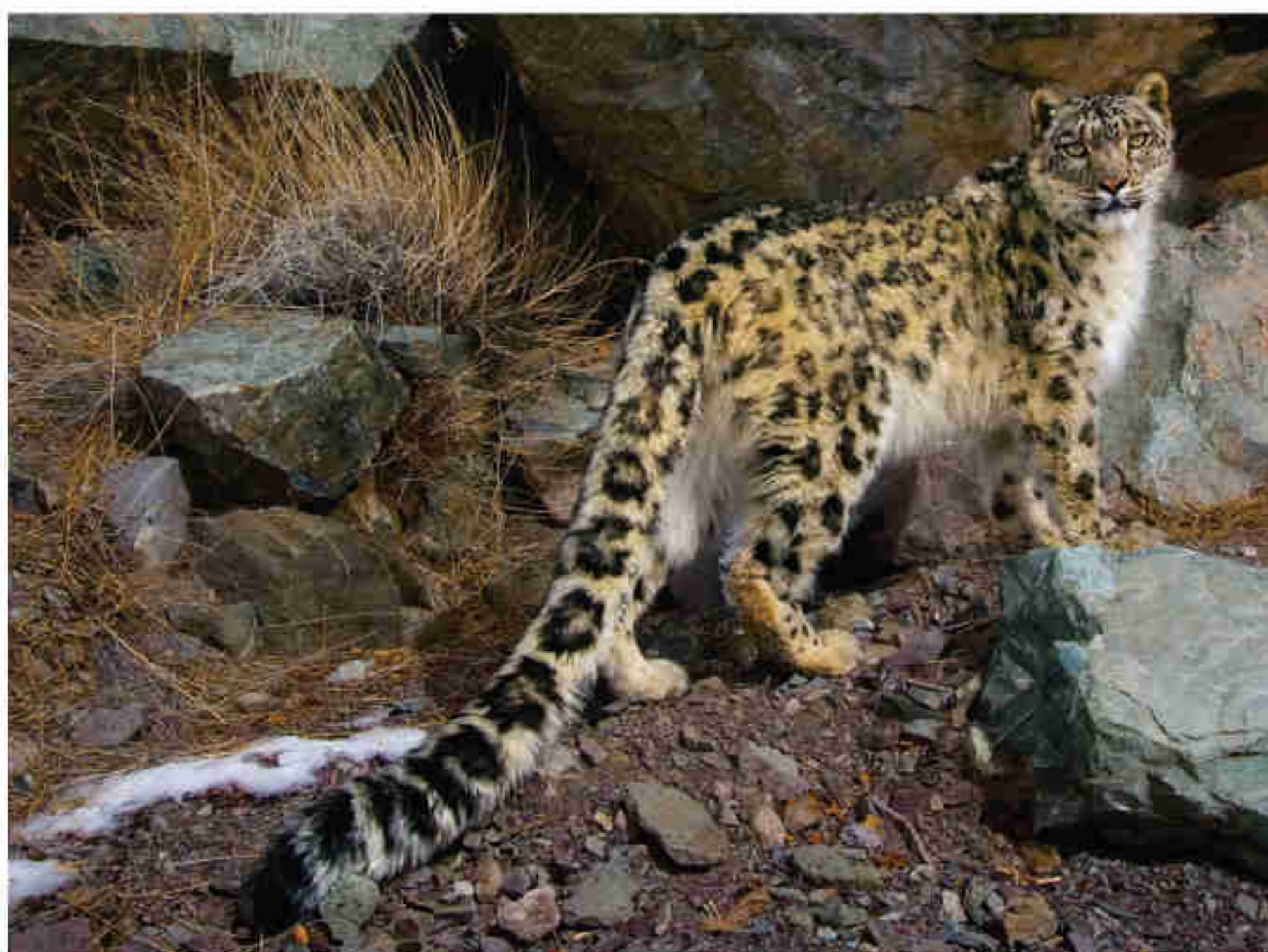
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## EDITOR'S NOTE

**In the photograph,** a snow leopard emerges from the shadows of the rugged Himalaya. Its thick, soft coat is lovely, but even more enchanting is its tail. It is nearly the length of its body. This is my first opportunity to really study a snow leopard; I can see the rosette spots, penetrating yellow eyes, and broad, delicate paws. I've photographed leopards throughout Africa, but never one to match this creature's beauty. In a darkened room, Steve Winter shows his next photograph—



The snow leopard's long tail helps stabilize the cat on rough terrain.

another snow leopard, this one with a dusting of snow on its back. I read George Schaller's *Stones of Silence* 20 years ago and ever since have wanted to make a photograph like this. Schaller's book transported me to the Himalaya; I dreamed of seeing snow leopards at those heights. The dream remains unfulfilled, but for now Steve is there for all of us. His commitment to this beautiful animal has produced the finest images of snow leopards I've seen. But reality casts a shadow on these pictures. As few as 3,500 snow leopards may survive. If I want to photograph them, I should move quickly. Schaller's words still hold the same urgency they had nearly three decades ago: "The snow leopard," he wrote, "might well serve as symbol of man's commitment to the future of the mountain world."

## PEOPLE BEHIND THE STORIES

### ■ Roger Atwood

Searching for "Afghanistan's Hidden Treasures," Atwood found in Kabul an unlikely



urban parallel. "I loved the stimuli of the Murad Khane neighborhood," he

says. "The smell of cumin and curry, the twittering of caged birds, the booksellers and goat merchants and crowds of shoppers. The area is being restored now, but it was nearly demolished in the 1970s, a fact that reminded me of my hometown, Boston, and how much heritage we lost in misguided urban renewal plans around the same time. I'm fascinated by the life of great cities—the way they evolve over generations, their traditions, their resilience."

### ■ Douglas H. Chadwick

"There were times when I was simply struggling to breathe in that high, thin air, getting



beaten up by hailstorms or inching across cliff ledges with terrifying drops below,"

says Chadwick of his days and nights in the Himalaya searching for snow leopards. But the riskiest thing the prolific *Geographic* contributor did while writing "Out of the Shadows" had nothing to do with big cats or bad weather. "To be honest," he admits, "it was sitting on my rear end in various vehicles, dodging the untamed truck traffic that rampages along narrow highways full of hairpin turns."



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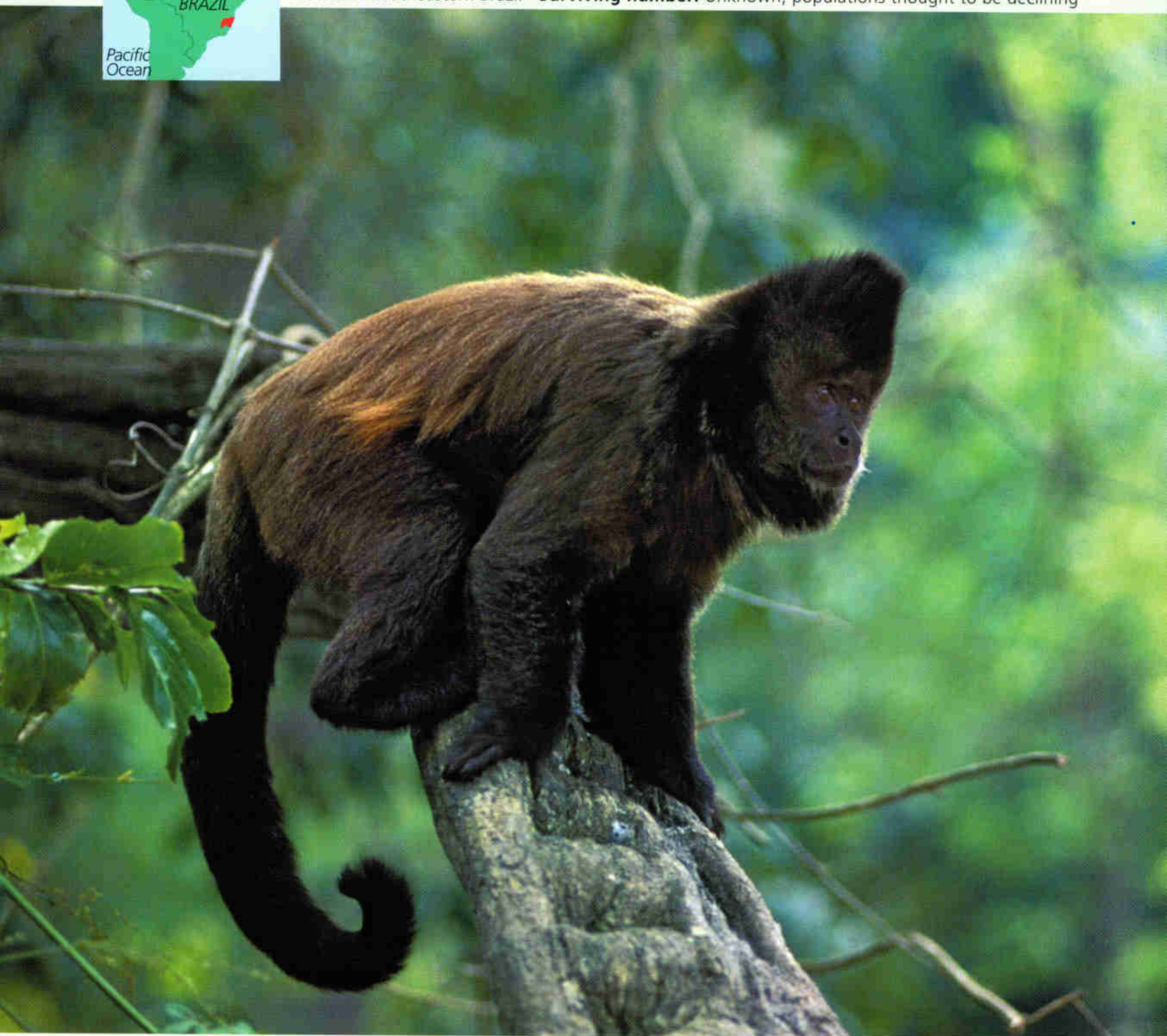




**Crested Capuchin** (*Cebus robustus*)

**Size:** Head and body length, 33 - 50 cm (13.0 - 19.7 inches); tail, approx. 45 cm (17.7 inches)

**Weight:** 2.0 - 3.8 kg (4.4 - 8.4 lbs) **Habitat:** Evergreen broadleaf rainforests and seasonal semi-deciduous forests of southeastern Brazil **Surviving number:** Unknown, populations thought to be declining



Photographed by Luiz Claudio Marigo

# WILDLIFE AS CANON SEES IT

Smart. Tough. Resourceful. And disappearing. On the surface, the crested capuchin seems well suited for survival. Robust and exceptionally intelligent, it excels at adapting to new situations. One of the most omnivorous of the New World monkeys, it has learned to take what the forest offers: everything from seeds to small mammals. And the bands of 10 to 20 it lives in show considerable cooperation, with group members carrying and even suckling young other than their own. But its life is tied up

in the trees, which are fast falling to farms, pastures and plantations. Vulnerable to hunting and the pet trade in its remaining redoubts, the crested capuchin proves that in today's world even the fittest may not survive.

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**February 2008** Our "Drying of the West" story drew a lot of mail this month. "Those living in the West should ask," wrote Craig Morgan of South Lake Tahoe, California, "is it worth rolling up their lawns and fallowing their farmlands so that modern-day land barons can continue building more urban sprawl? Is this the civilization they desire?"

➤ Comment on June stories at [ngm.com](http://ngm.com).

## Drying of the West

Your article talks about the tension between urban and rural water users as urban water managers take advantage of bought-up water rights, drill wells, and export water from rural aquifers. One source of this tension is the lack of consideration in how state and area water officials treat rural residents and their concerns of how water exportation from aquifers—relied on for our only source of water—affects wells. Consider this: When the water level of a particular aquifer drops to the point of being worthless to a user, the water authority simply moves on to the next aquifer, whereas rural residents are stuck with having to drill a new, deeper well or face the real possibility of having to pick up and move on if no more water is to be found. Water managers need

to remember the primary rule of water rights. Mother Nature has no obligation to honor any man's water rights. When the water is gone, it's gone.

**GREG GRIFFITH**  
Reno, Nevada

As conditions continue to worsen in the western states, I fear there will be more calls to tap the Great Lakes for water. This subject is raised often by government agencies and people who do not stop to realize the consequences. If the lakes were tapped and levels dropped, ships could no longer navigate the waterways. Hydroelectric generation would be curtailed or even finished at Niagara. Cities on the lakes such as Chicago and Toronto would have to spend millions to extend water intakes. Those western states had better start strict conservation programs and invest in research on improved desalinization projects.

**KEN HEDGER**  
Goderich, Ontario

I suspect that the pool in the photo [pages 104-5] is actually an apartment-complex pool. The real irony of pools in the Phoenix area is precisely that they are not used by the density of people shown in the picture. If only they were,

the water use would be more justified. The homes shown in the picture on page 113 are likely occupied by about three people. Most of those families will use their pool only a couple of times a week. Regardless of use, about one to two centimeters of water will evaporate every day during the five months of summer that we have in Arizona. In addition, the one-kilowatt pool pump must be run eight to twelve hours a day during the summer, and four to eight hours during the winter to keep the water filtered and clean. Unused pools do not just waste water; they waste energy too.

**LANCE C. LABUN**  
Tempe, Arizona

Robert Kunzig's otherwise excellent article was marred by one jarring description that added nothing to his narrative and was remarkable only for its incongruousness. I refer to the description of the Southern Nevada Water Authority's Pat Mulroy as a "crisp, tanned, fiftysomething blonde with a tailored look and a forceful personality." It is notable that no other human being in the article is described by his or her appearance. At least one-half of your readership could live without the disappointing experience of being reminded, yet again, that its most notable attributes are cosmetic. For your information, what you probably want to know about me is that I am a petite, bespectacled brunette who would really appreciate being able to pick up your magazine without preparing for a possible gratuitous, subtle insult.

**JUNE LEHRMAN**  
Culver City, California

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## 1 The Neptune Project LONG ISLAND, NEW YORK

This project has enabled Long Island residents to receive reliable, low-cost electricity without the building of additional power plants and overhead transmission lines. Leveraging the strength of its technology, Siemens made it possible to transmit power to Long Island, N.Y., by connecting it to the adjacent power grid via a 65-mile undersea and underground cable—a solution that has less impact on the environment.

again. Infrastructure technologies from Siemens are one of the major forces behind this rebirth. Siemens built half the communication infrastructure in Argentina and is a major player in healthcare and infrastructure in the country. Several landmarks are lit up with technology from Osram, a Siemens company. This year, Siemens Argentina will celebrate its 100th anniversary.

## 5 Reclaiming a Valuable Natural Resource SINGAPORE

With the increasing demands on our natural water resources, wastewater has become viewed as a raw material. In fact, recycling wastewater can satisfy many of our needs for domestic and industrial water, and today's purifying technologies are advanced enough to create drinking water. Siemens provides state-of-the-art water recycling technologies to Singapore, a pioneer in wastewater recycling.

## 3 A Better City Life LONDON, ENGLAND

London's infrastructure has not always kept up with its rapid population growth. To help, Siemens has supplied the city with traffic guidance systems and modern trains and has created a satellite-based bus information system to help with scheduling. Since the introduction of London's congestion charge system in 2003, traffic—and gasoline consumption—has fallen significantly. Siemens supplied video and IT technology for the western extension of the system and will also service the toll system until 2016.

## 6 Melbourne's Tram System Runs on Siemens MELBOURNE, AUSTRALIA

With the third largest tram network in the world, Melbourne celebrated its 100-year tram history with a pop-art-covered tram fleet provided by Siemens. About 145 million passengers travel on the approximately 152-mile-long system each year. Siemens is responsible for the design, manufacturing, and maintenance of the trains.

## 2 Building a City's Infrastructure BUENOS AIRES, ARGENTINA

Just five years after Argentina was shaken by a severe financial crisis, Buenos Aires is booming once

5



**Reclaiming Water**

SINGAPORE

3



**Traffic Reduction**

2



**Efficient Systems**

Buenos Aires  
ARGENTINA

6



**Tram Power**

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## 4 World's Most Powerful Gas Turbine IRSCHING, GERMANY

Siemens is the creator of the world's most powerful gas turbine—so strong it could power a city like Hamburg, Germany. Future plans include transforming the turbine into a combined-cycle power plant with an efficiency rating of more than 60 percent—which would be a world record. This power plant will emit approximately 2.8 million tons less carbon dioxide per year than the average coal-fired plant—equivalent to the emissions of about one million automobiles.

## 7 More Efficient Power Generation JOHANNESBURG, SOUTH AFRICA

In South Africa, Siemens has started work on the world's largest modernization project at a coal-fired power plant. The client, South African power utility Eskom, has commissioned Siemens to install a new central control room and construct a simulator for training operating personnel. The modernization measures will make the power plant more reliable and easier to operate while at the same time reducing maintenance and life cycle costs.

7



**Better Coal**

Johannesburg  
SOUTH AFRICA



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Answers for the environment.

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# LETTERS

The U.S. has a power grid to share electric power. We also have an interstate highway system. We need a water grid to move water. The system would need diversion devices, not just dams, that would take only water in excess of normal flow. Reservoirs would be located in remote areas. If they stored water year-round, they could become recreational areas. Water would be transferred by pipes, tunnels, and canals. The grid would be very expensive and take a long time to achieve, but in the long run it would pay for itself in flood control, farming, and other expensive water-need requirements.

**JAKE POLDER**  
Whittier, California

With increasing consumption and a higher likelihood of intense droughts, there will be some hard decisions to make regarding water use in the future. One user that needs further mention is the environment, which competes for scarce resources alongside cities and agriculture. This is seen in the Colorado River Delta (CRD), which is less than 10 percent of its original size and is sustained by agricultural

runoff and municipal wastewater. The CRD was once a rich habitat for wildlife and indigenous people, but after damming and diverting the river, which started in the 1930s, the CRD began to lose its lifeblood. This is not to say that the water has not been put to important uses; it irrigates 3.5 million acres and quenches the thirst of 30 million people. However, there are ways to support the CRD while balancing other water uses.

**KAREN HYUN**  
Washington, D.C.

## On the Trail of a Ghost

I thought the author might have cited a haiku that Basho wrote after losing his house to fire. It is my favorite: "My house burned down. / Now I can better see / The rising moon."

**CHARLES GARY SIGNOR**  
Harrisburg, Pennsylvania

*Though this haiku is often attributed to Basho, experts we've consulted cannot find it in his writing. It may be by Masahide, a contemporary of Basho.*

I was impressed by the shift in format used for "On the Trail of a Ghost." It added force to Michael Yamashita's already powerful photography and allowed Howard Norman's text to be artfully displayed. Having to hold and look sidelong at the issue was a novelty.

**DONALD W. JOHNSTON**  
Oklahoma City, Oklahoma

What possessed you to print the article on the haiku master sideways? It was definitely a bad decision. It made the article totally unreadable.

**MARY ZELLE**  
Hixson, Tennessee

Thank you for the beautiful interpretation of Matsuo Basho. I was impressed by its unique horizontal format and exquisite photographs. The first haiku, "...a frog jumping into a pond," is widely known in Japan. However, I was startled that the character for "frog" is missing from the calligraphy on page 145. Did the character disappear into the water?

**KYO TAKAHASHI**  
Roscommon, Michigan

*We regret that a production error caused Basho's frog to jump right off the page. Here is the poem in its entirety:*



## Mexico's Other Border

The article quoted a 56-year-old Honduran migrant. "You Americans have plenty of work. You're not going to take out the garbage. That is for the Latino." I'm a 56-year-old American Vietnam veteran who has been taking out the garbage and cleaning 27 toilets five days a week for the past 25 years. I have grown tired of Latinos and the media claiming Americans won't do the dirty work. I do the dirty work, and I'm paid for my labor.

**DAVID PORTER MISSO**  
Tulelake, California

## Corrections, Clarifications

### February 2008:

**Drying of the West** The map on page 101 misplaced Albuquerque, New Mexico, and omitted Santa Fe. Ponderosa pine seeds were incorrectly described as wingless on page 102; they do have small wings.

**On the Trail of a Ghost** The birds flying across the map of Japan on page 140 are whooping cranes, native only to North America.



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## LETTERS

### Black Pharaohs

The article shows African people to be more than just a group exported as slaves to foreign lands. It shows the rise of African leadership in a region that dominated much of the ancient world: Egypt. All we can hope is that history books will be rewritten so that our children will learn the truth of our history and that all people, regardless of race, skin color, or culture, made an equally significant impact on our world.

**WINSOME LORAIN PETER**  
Beijing, China

Serious academic attention to the Nubian pharaohs has been long overdue and certainly hampered by the construction of the Aswan High Dam. The disregard for this period of Egyptian history was only amplified starting in 1959, when an international team made extraordinary efforts to relocate the temples of Ramses II at Abu Simbel to protect them from the same rising waters that covered critical areas of Lower Nubia. And now another dam threatens our further uncovering of this great civilization. So what exactly have we learned from history?

**KEITH NEMLICH**  
Manchester Center, Vermont

Actually, weren't all the pharaohs black? The ancient Egyptians claimed they migrated to Egypt from Ethiopia. What color are the folks in Ethiopia? Herodotus, in a roundabout way, stated the Egyptians had dark skin and hair "like wool." Look at the mask of Tutankhamun. Does he look like someone from Nairobi or Paris or Riyadh? The only reason ancient Egyptians are portrayed as nonblack is that when Egyptology started, white people were enslaving black people and justified it by claiming that blacks were inferior. This wouldn't hold water if people realized that there had been a black civilization that the ancient Greeks had borrowed many of their ideas from.

**RICK POTTHOFF**  
Houston, Texas





: \$980



: priceless

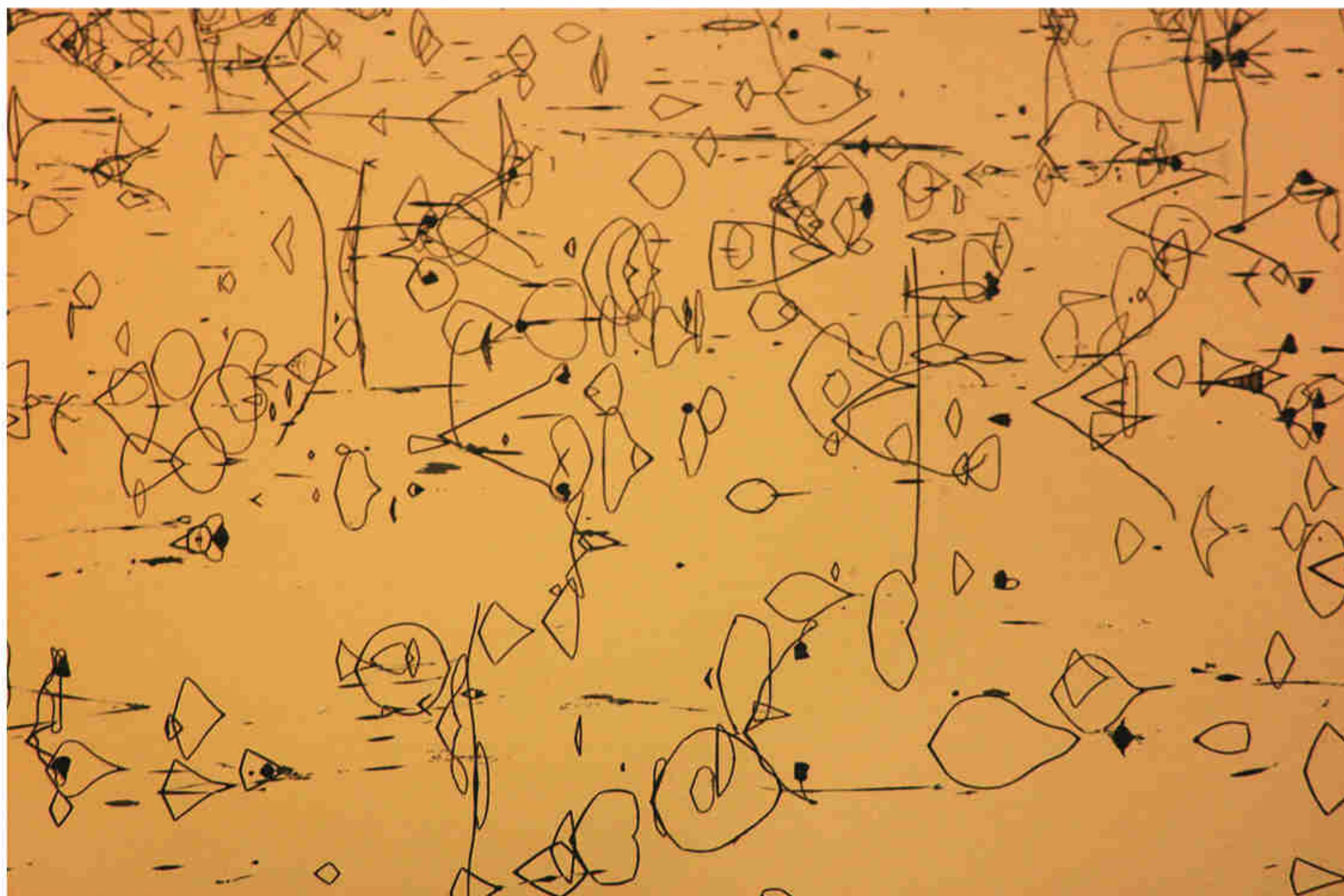
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**Deep Thoughts** Mysterious pictures of watery scenes inspired both the Your Shot editors and online voters this month. Now you can decorate your computer desktop with wallpaper of Your Shot photographs by choosing from our Daily Dozen top shots available for download. Get guidelines for sending in your own pictures, a submission form, and more information at [ngm.com/yourshot](http://ngm.com/yourshot).



**Ashish Dubey** Indore, India

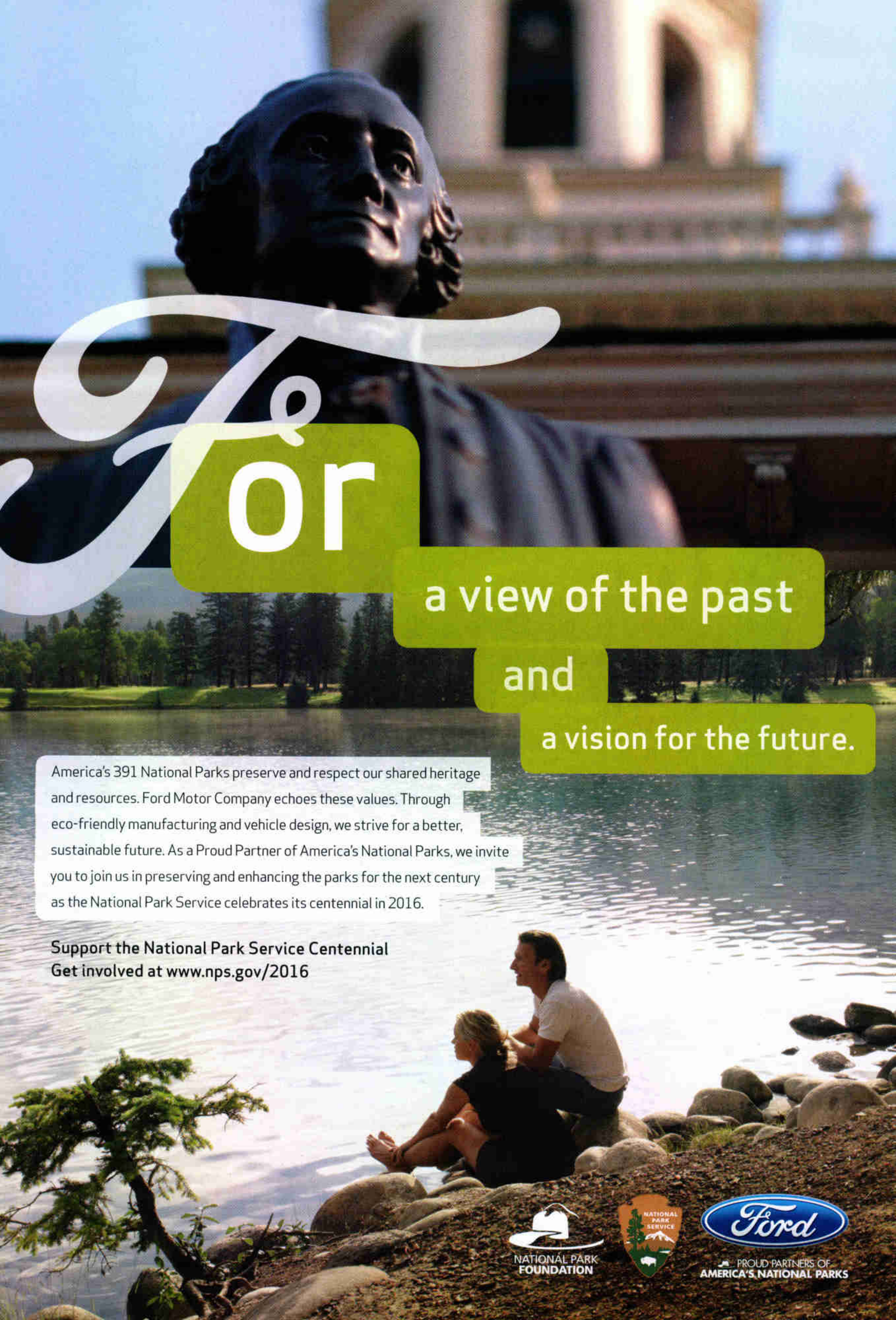
Bent reeds mirrored in the surface of a lake looked like modern art to Ashish Dubey, a 44-year-old college physics teacher. He shot this at sunrise on Sirpur Lake, a favorite local landing spot for migratory birds.

**Finn Müller** Amsterdam, Netherlands

Somewhere on the road to Cape York, Australia, photography student Finn Müller, 24, saw this stranded tree. "The tree was not growing on an island, from what I could see. It was just standing there in the water," he says. This picture was voted an *ngm.com* audience favorite.







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a view of the past

and

a vision for the future.

America's 391 National Parks preserve and respect our shared heritage and resources. Ford Motor Company echoes these values. Through eco-friendly manufacturing and vehicle design, we strive for a better, sustainable future. As a Proud Partner of America's National Parks, we invite you to join us in preserving and enhancing the parks for the next century as the National Park Service celebrates its centennial in 2016.

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AMERICA'S NATIONAL PARKS





These guns in Pyongyang were props—perhaps for a drill—but they reflect North Korea's military mind-set.

*Yannis Kontos is a photographer for the Polaris Images agency. More of his work is online at [yanniskontos.com](http://yanniskontos.com).*

**Arm's Length** I used to dream about seeing North Korea, the militantly communist Hermit Kingdom that few outsiders get to visit. Unfortunately, North Korea didn't want to see me. For three years I tried—and failed—to get a journalist visa, so I traveled as a tourist instead, flying to Pyongyang with a small, state-sanctioned group led by government-appointed guides. Since visitors are forbidden to carry professional cameras (photography, in general, makes officials nervous), I packed two small, amateur models. When I used them, I often shot from the hip—literally—snapping pictures without looking through the viewfinder. Every night at the hotel I'd download my photos to an MP3 player while my roommate slept. Sometimes I felt like a spy. Other days I felt like an extra on a huge movie set, where citizens were the actors, and the director hovered somewhere in the shadows, making sure we stuck to the script.

I wasn't surprised by the nation's story line—the revolutionary passion, the emphasis on ethnic purity, the near deification of the "Great Leader," Kim Il Sung (1912-1994), and the reverence for his son, the "Dear Leader," Kim Jong Il. But I didn't expect North Koreans to be so happy. They waved at me. They smiled. They seemed unfazed by—or unaware of—how the world perceived their country. Sure, maybe that's part of the performance, but it's tough to tell. I couldn't ask provocative questions, and most people were afraid to talk. While I managed to capture some hidden corners of this country, it was the eerie silence that really opened my eyes.



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high-flyer.

**We think  
successful  
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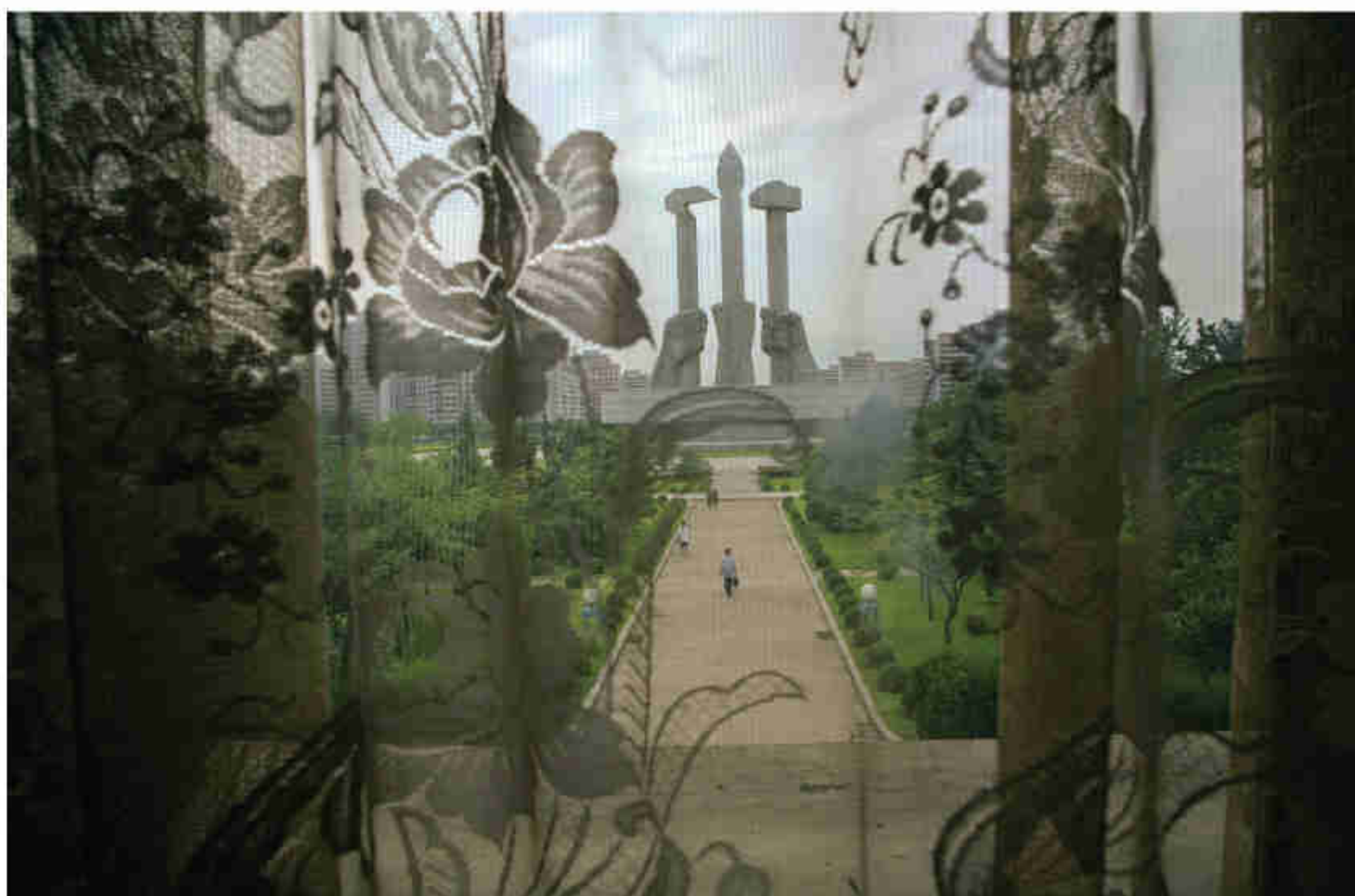
**Thinking New Perspectives.**

**CREDIT SUISSE** 





One evening at the Yanggakdo Hotel in Pyongyang, I saw these men playing billiards. They're probably hotel workers, because most of the guests are either tourists or Chinese businessmen. The hotel keeps visitors on a tight leash; there's nothing to do at night anyway, even if you were allowed to go out.



There's no escape from all the political art in Pyongyang, including this 160-foot-high hammer, sickle, and brush built in 1995 to celebrate the 50th anniversary of North Korea's Workers' Party. Communism may be on the wane elsewhere, but giant statuary serves as a potent reminder to the people: The state is far bigger than you are.





*Dungarpur, India*

*ISO 200 f/5.6 1/60 sec*



The new Canon PowerShot G9. It doesn't know it's a point and shoot.

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*image*ANYWARE





As our train clattered through a station not far from the capital, I secretly snapped this shot. Who are these men? Maybe they're railway workers on a break. Maybe not. I didn't dare ask. Too many questions would arouse suspicion. As a result, many of my pictures remain enigmatic to me—like a silent movie without subtitles.



Lush crops line this stretch of track, but on a train trip across the countryside, another truth emerged: Most farmers lash plows to animals, not tractors, and cut their fields with scythes. North Korea's fuel crisis keeps them from using what machinery they have. The country depends heavily on foreign food aid to avert widespread hunger.



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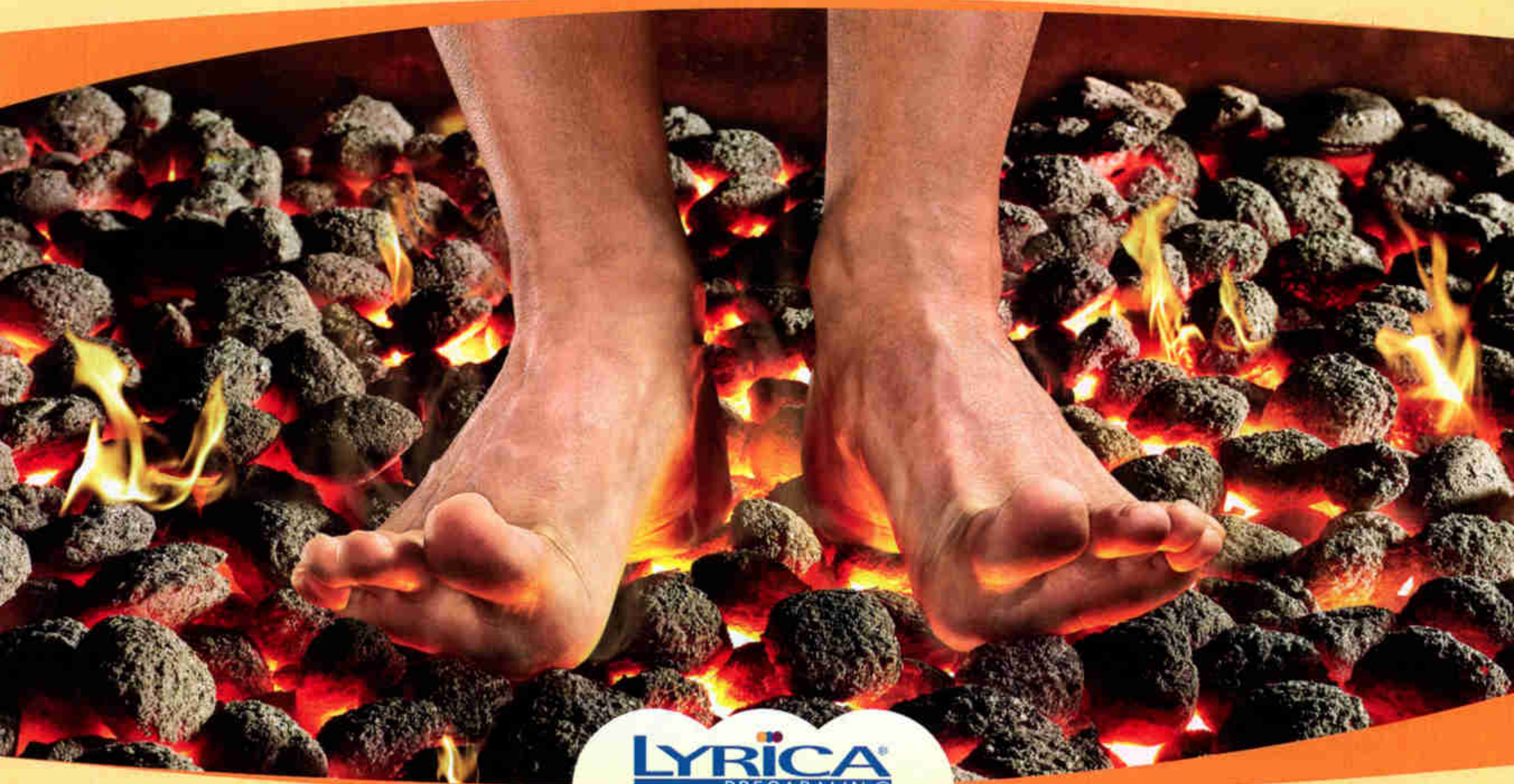
There's precious little traffic to direct in Pyongyang, yet this policewoman stands ready, just in case. While bicyclists and buses drift along the city's broad boulevards, a rush-hour bustle of happy workers on their way to farm and factory remains a communist daydream. As the billboard says: "Communism forever in life or death!"



The "Great Leader," Kim Il Sung, died in 1994, yet he lives on—waving from this mural in Pyongyang and looming as North Korea's constitutionally enshrined "eternal president." Even the calendar here—pegged not to Christ's birth, but to Kim's, in 1912—is about self-glorification. I've traveled the globe, but North Korea is a whole different world.



# There's relief for pain like this. Ask your doctor about Lyrica®.



**LYRICA®**  
PREGABALIN ©  
capsules  
Designed for Relief

**Do you feel burning pain in your feet? Or tingling, numbness, stabbing or shooting sensations?**

If so, you may have painful neuropathy, also known as nerve pain. This type of pain is different from musculoskeletal (muscle or joint) pain, and may need a different type of treatment. Only Lyrica (pronounced LEER-i-kah) is FDA-approved to treat two of the most common types of nerve pain, Diabetic Nerve Pain and Pain after Shingles. Lyrica is specially designed to provide the relief you need. It works on the nerves that cause this pain. So you can start to think about other things besides your pain. Ask your doctor if Lyrica can help. Lyrica is one of several treatment options for you and your doctor to consider.

**Prescription Lyrica is not for everyone.** Tell your doctor right away about any serious allergic reaction that causes swelling of the face, mouth, lips, gums, tongue or neck or affects your breathing or your skin. Also tell your doctor about any changes in your eyesight, including blurry vision, muscle pain along with a fever or tired feeling, skin sores due to diabetes or if you are planning to father a child. Some of the most common side effects of Lyrica are dizziness and sleepiness. Others are weight gain, blurry vision, dry mouth, feeling "high," swelling of hands and feet and trouble concentrating. You may have a higher chance of swelling, hives or gaining weight if you are also taking certain diabetes or high blood pressure medicines. Do not drive or operate machinery until you know how Lyrica affects you. Do not drink alcohol while taking Lyrica. Be especially careful about medicines that make you sleepy. If you have had a drug or alcohol problem, you may be more likely to misuse Lyrica. Talk with your doctor before you stop taking Lyrica or any other prescription medication.

*Please see important patient information on adjacent pages.*

To learn more visit [www.lyrica.com](http://www.lyrica.com) or call toll-free 1-888-9-LYRICA (1-888-959-7422).

*You are encouraged to report negative side effects of prescription drugs to the FDA.  
Visit [www.FDA.gov/medwatch](http://www.FDA.gov/medwatch) or call 1-800-FDA-1088.*



## PATIENT INFORMATION

### **Lyrica®** (*pregabalin*) Capsules © (LEER-i-kah)

Read the Patient Information that comes with LYRICA before you start taking it and each time you get a refill. There may be new information. This leaflet does not take the place of talking with your doctor about your condition or treatment. If you have any questions about LYRICA, ask your doctor or pharmacist.

#### **What is the most important information I should know about LYRICA?**

1. **LYRICA may cause serious allergic reactions.**
  - **Call your doctor right away if you think you have any of the following symptoms of a serious allergic reaction:**
    - swelling of the face, mouth, lips, gums, tongue or neck
    - have any trouble breathing
    - Other allergic reactions may include rash, hives and blisters.
2. **LYRICA may cause dizziness and sleepiness.**
  - **Do not drive a car, work with machines, or do other dangerous activities until you know how LYRICA affects how alert you are. Ask your doctor when it is okay to do these activities.**
3. **LYRICA may cause problems with your eyesight, including blurry vision.**
  - **Call your doctor if you have any changes in your eyesight.**

#### **What is LYRICA?**

LYRICA is a prescription medicine used in adults, 18 years and older, to treat:

- pain from damaged nerves (neuropathic pain) that happens with diabetes
- pain from damaged nerves (neuropathic pain) that follows healing of shingles (a painful rash that comes after a herpes zoster infection)
- partial seizures when taken together with other seizure medicines
- fibromyalgia

LYRICA has not been studied in children under 18 years of age.

#### Pain from Damaged Nerves (neuropathic pain)

Diabetes and shingles can damage your nerves. Pain from damaged nerves may feel sharp, burning, tingling, shooting, or numb. If you have diabetes, the pain can be in your arms, hands, fingers, legs, feet, or toes. If you have shingles, the pain is in the area of your rash. You may experience this kind of pain even with a very light touch. LYRICA can help relieve the pain. Some people taking LYRICA had less pain by the end of the first week of LYRICA therapy. LYRICA may not work for everyone.

#### Partial Seizures

Partial seizures start in one part of the brain. A seizure can make you fearful, confused, or just feel “funny”. You may smell strange smells. A seizure may cause your arm or leg to jerk or shake. It can spread to other parts of your brain, make you pass out, and cause your whole body to start jerking.

LYRICA can lower the number of seizures for people who are already taking seizure medicine.

#### Fibromyalgia

Fibromyalgia is a condition which includes widespread muscle pain and difficulty performing daily activities. LYRICA can help relieve the pain and improve function. Some people taking LYRICA had less pain by the end of the first week of LYRICA therapy. LYRICA may not work for everyone.

#### **Who Should Not Take LYRICA?**

**Do not take LYRICA if you are allergic to any of its ingredients.** The active ingredient is pregabalin. See the end of this leaflet for a complete list of ingredients in LYRICA.

#### **What should I tell my doctor before taking LYRICA?** **Tell your doctor about all your medical conditions, including if you:**

- **have any kidney problems or get kidney dialysis**
- **have heart problems including heart failure**
- **have a bleeding problem or a low blood platelet count**
- **are pregnant or plan to become pregnant.** It is not known if LYRICA may harm your unborn baby. You and your doctor will have to decide if LYRICA is right for you while you are pregnant.
- **are breastfeeding.** It is not known if LYRICA passes into breast milk and if it can harm your baby. You and your doctor should decide whether you should take LYRICA or breastfeed, but not both.

**Tell your doctor about all the medicines you take including prescription or non-prescription medicines, vitamins or herbal supplements.** LYRICA and other medicines may affect each other. Especially tell your doctor if you take:

- angiotensin converting enzyme (ACE) inhibitors. You may have a higher chance for swelling and hives if these medicines are taken with LYRICA. See “What is the most important information I should know about LYRICA?”
- Avandia® (rosiglitazone) or Actos® (pioglitazone) for diabetes. You may have a higher chance of weight gain or swelling if these medicines are taken with LYRICA. See “What are the possible side effects of LYRICA.”
- any narcotic pain medicine (such as oxycodone), tranquilizers or medicines for anxiety (such as lorazepam). You may have a higher chance for dizziness and sleepiness if these medicines are taken with LYRICA. See “What is the most important information I should know about LYRICA?”
- any medicines that make you sleepy

Know all the medicines you take. Keep a list of them with you to show your doctor and pharmacist each time you get a new medicine.

**Tell your doctor if you plan to father a child.** Animal studies showed that pregabalin, the active ingredient in LYRICA, made male animals less fertile and caused sperm abnormalities. Also, in animal studies, birth defects occurred in the offspring of male animals who



were treated with pregabalin. It is not known if these effects would happen in people.

#### How should I take LYRICA?

- Take LYRICA exactly as prescribed. Your doctor may adjust your dose during treatment. Do not change your dose without talking to your doctor.
- Do not stop taking LYRICA suddenly without talking to your doctor. If you stop taking LYRICA suddenly, you may have headaches, nausea, diarrhea or trouble sleeping. Talk with your doctor about how to slowly stop LYRICA.
- LYRICA is usually taken 2 or 3 times a day, depending on your medical condition. Your doctor will tell you how much LYRICA to take and when to take it. Take LYRICA at the same times each day.
- LYRICA may be taken with or without food.
- If you miss a dose by a few hours, take it as soon as you remember. If it is close to your next dose, just take LYRICA at your next regular time. **Do not** take two doses at the same time.
- If you take too much LYRICA, call your doctor or poison control center or go to the nearest emergency room right away.

#### What Should I Avoid While Taking LYRICA?

- **Do not drive a car, work with machines, or do other dangerous activities until you know how LYRICA affects how alert you are.** See "What is the most important information I should know about LYRICA?"
- **Do not drink alcohol while taking LYRICA.** LYRICA and alcohol can affect each other and increase side effects such as sleepiness and dizziness. This can be dangerous.

**Do not take other medicines without talking to your doctor.** Other medicines include prescription and non-prescription medicines, vitamins, and herbal supplements. LYRICA and other medicines may affect each other and increase the side effects of swelling, sleepiness and dizziness. Be especially careful about medicines that make you sleepy (such as sleeping pills, anxiety medicines, tranquilizers and some antihistamines, pain relievers and seizure medicines).

#### What are the possible side effects of LYRICA?

**LYRICA may cause side effects including:**

- **allergic reactions.** See "What is the most important information I should know about LYRICA?"
- **weight gain and swelling of the hands and feet (edema).** Weight gain may affect the management of diabetes. Weight gain and swelling can also be a serious problem for people with heart problems.
- **dizziness and sleepiness.** See "What is the most important information I should know about LYRICA?"
- **eyesight problems.** See "What is the most important information I should know about LYRICA?"
- **unexplained muscle problems, such as muscle pain, soreness, or weakness.** If you develop these symptoms, especially if you also feel sick and have a fever, tell your doctor right away.

#### The most common side effects of LYRICA are:

- dizziness
- blurry vision

- weight gain
- sleepiness
- trouble concentrating
- swelling of hands and feet
- dry mouth

LYRICA caused skin sores in animals. Although skin sores were not seen in studies in people, if you have diabetes, you should pay extra attention to your skin while taking LYRICA and tell your doctor of any sores or skin problems.

LYRICA may cause some people to feel "high." Tell your doctor, if you have abused prescription medicines, street drugs, or alcohol in the past.

Tell your doctor about any side effect that bothers you or that does not go away.

These are not all the side effects of LYRICA. For more information, ask your doctor or pharmacist.

#### How should I store LYRICA?

- Store LYRICA at room temperature, 59 to 86° F (15 to 30° C) in its original package.
- Safely throw away LYRICA that is out of date or no longer needed.
- **Keep LYRICA and all medicines out of the reach of children.**

#### General information about LYRICA

Medicines are sometimes prescribed for conditions other than those listed in patient information leaflets. Do not use LYRICA for a condition for which it was not prescribed. Do not give LYRICA to other people, even if they have the same symptoms you have. It may harm them.

This leaflet summarizes the most important information about LYRICA. If you would like more information, talk with your doctor. You can ask your doctor or pharmacist for information about LYRICA that is written for health professionals.

You can also visit the LYRICA website at [www.LYRICA.com](http://www.LYRICA.com) or call 1-866-4LYRICA.

#### What are the ingredients In LYRICA?

**Active ingredient:** pregabalin

**Inactive ingredients:** lactose monohydrate, cornstarch, talc;

**Capsule shell:** gelatin and titanium dioxide; Orange capsule shell: red iron oxide; White capsule shell: sodium lauryl sulfate, colloidal silicon dioxide. Colloidal silicon dioxide is a manufacturing aid that may or may not be present in the capsule shells.

**Imprinting ink:** shellac, black iron oxide, propylene glycol, potassium hydroxide.

Manufactured by:  
Pfizer Pharmaceuticals LLC  
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LAB-0299-5.0

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June 2007



# VISIONS OF EARTH





**New York City** Secret prize on the urban game board, a miniature garden brightens a Rockefeller Center rooftop seven stories above midtown traffic. Four gardeners labor eight hours a week to keep its lawn and hedges trim.

PHOTO: VINCENT LAFORET



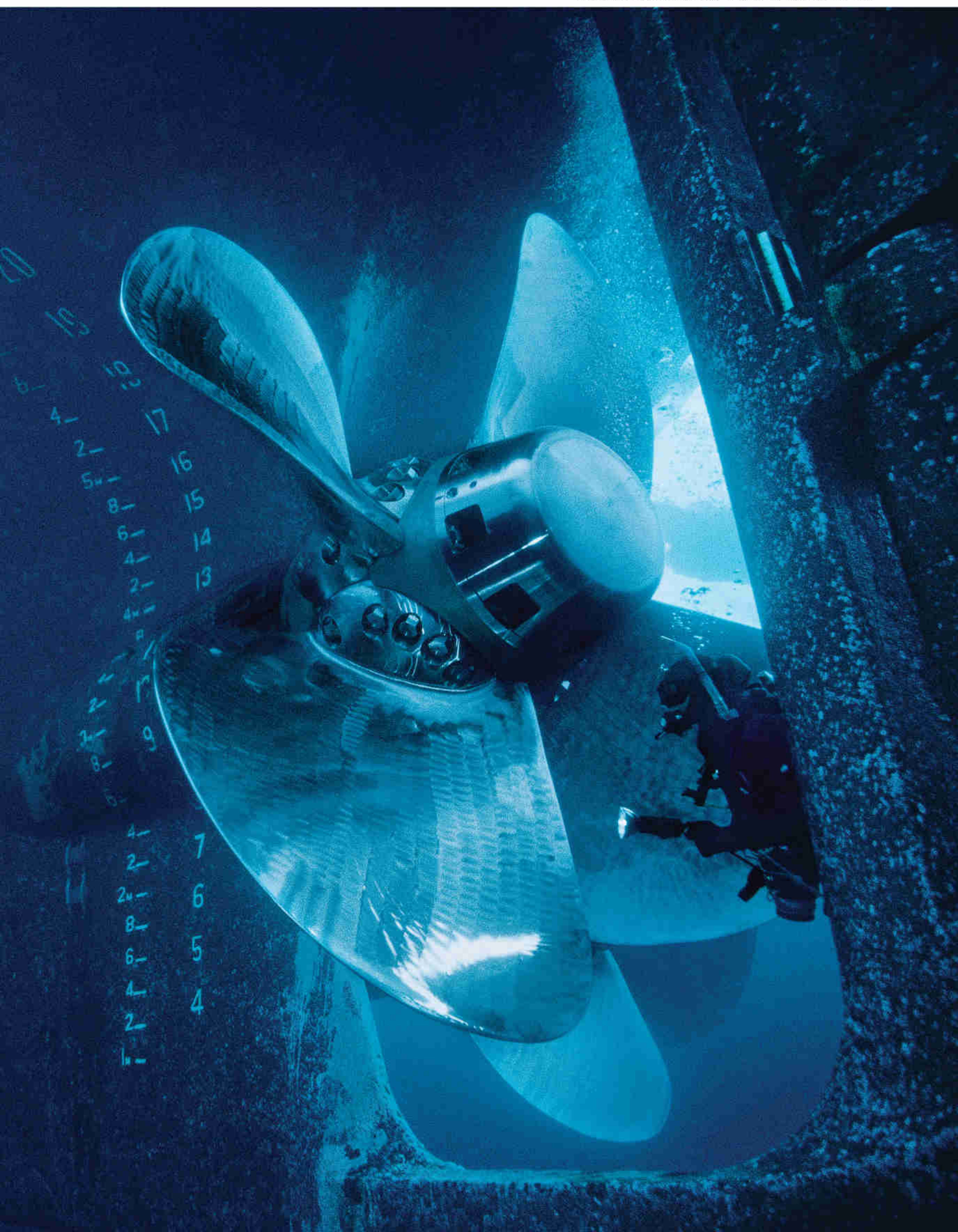


**Arctic Ocean** The 22-ton stainless steel propellers on the icebreaker *Louis S. St-Laurent* pause in their work pushing the Canadian vessel through frozen waters—allowing a diver to venture near.





PHOTO: PAUL NICKLEN, NATIONAL GEOGRAPHIC IMAGE COLLECTION





**Weslaco, Texas** Ruffled, tiaraed, and manicured, twins Vanessa and Veronica Del Toro wait to leave for their *quinceañera* reception—the 15th-birthday party that, in Latino culture, marks their coming of age.





➤ See more Visions of Earth images at [visionsofearth.ngm.com](http://visionsofearth.ngm.com).

PHOTO: PENNY DE LOS SANTOS







## Most in Translation

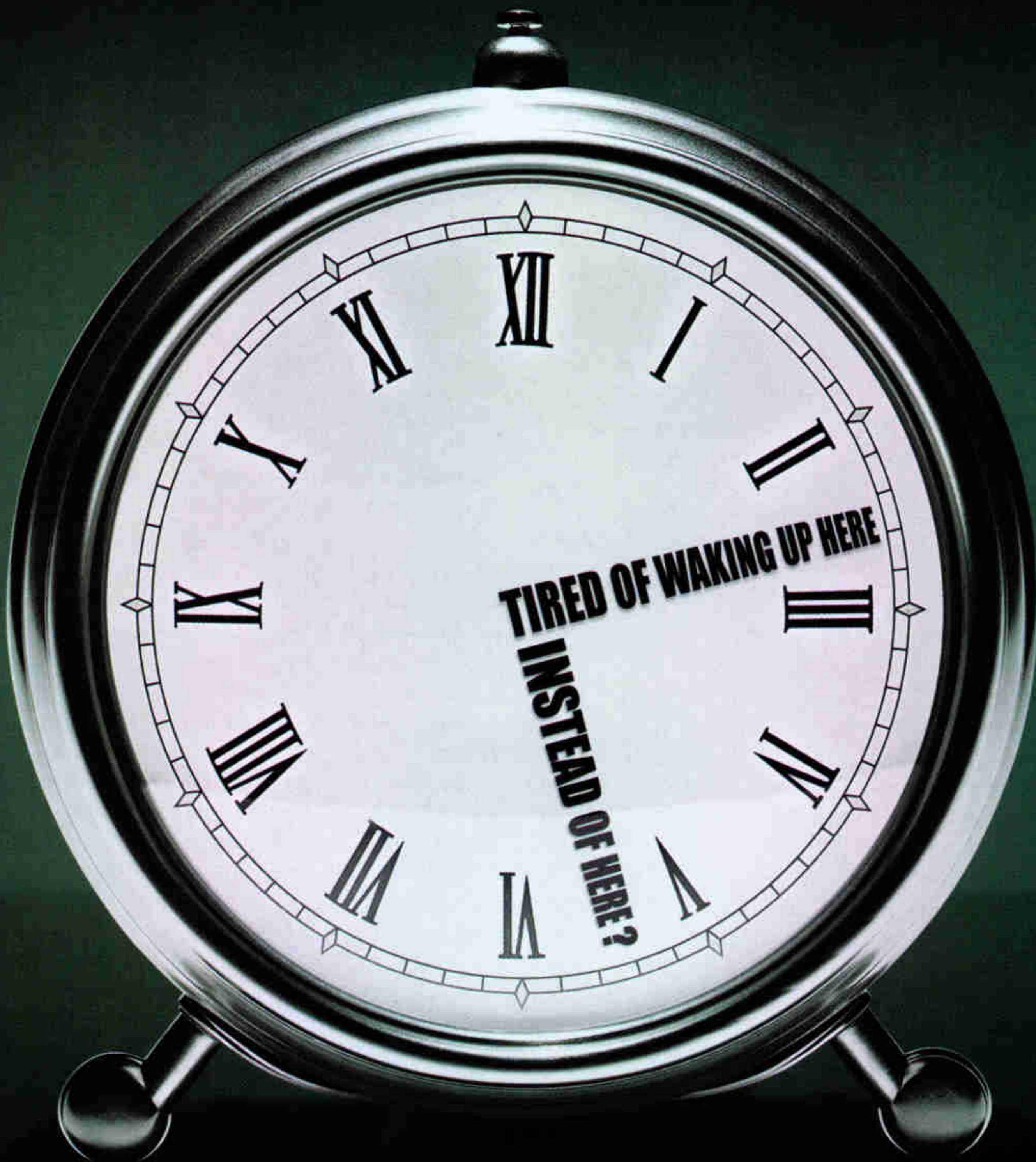
In this UNESCO compilation of most translated authors, size of last name corresponds to number of translations (listed below name). Color indicates language of original publication.

English German French Russian Danish  
Ancient Greek Italian/Latin/Polish Swedish



UNESCO's Index Translationum speaks volumes about topics and authors of global appeal. The bibliography of translations lists some 1.7 million books from 130 countries in 820 languages. Along with the authors above, works by Walt Disney Productions and the Old and New Testament are among the most widely translated. J. K. Rowling hasn't cracked the top 50—yet. But lots of U.S. authors have. "Translation from other languages into American English," says Rainer Schulte, of the Center for Translation Studies at the University of Texas, Dallas, "is limited in comparison to what gets translated from English into other languages." —Diane Cole





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SO YOU WAKE UP LESS FREQUENTLY AND FALL BACK TO SLEEP FASTER.**

It's the only sleep aid that has 2 layers. The first helps you fall asleep. The second helps you stay asleep.\* So you wake up ready for the day. Ask your healthcare provider if Ambien CR is right for you. **AMBIEN<sup>CR</sup>. A good night's sleep from start to finish.<sup>™</sup>**

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AMBIEN CR is indicated for the treatment of insomnia.

#### IMPORTANT SAFETY INFORMATION

AMBIEN CR is a treatment option you and your healthcare provider can consider along with lifestyle changes and can be taken for as long as your provider recommends. Until you know how AMBIEN CR will affect you, you shouldn't drive or operate machinery. Be sure you're able to devote 7 to 8 hours to sleep before being active again. Sleepwalking, and eating or driving

while not fully awake, with amnesia for the event, have been reported. If you experience any of these behaviors contact your provider immediately. In rare cases, sleep medicines may cause allergic reactions such as swelling of your tongue or throat, shortness of breath or more severe results. If you have an allergic reaction while using AMBIEN CR, contact your doctor immediately. Side effects may include next-day drowsiness, dizziness, and headache. It's non-narcotic; however, like most sleep medicines, it has some risk of dependency. Don't take it with alcohol.



**sanofi aventis**

Because health matters

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February 2008 Printed in USA

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit [www.fda.gov/medwatch](http://www.fda.gov/medwatch) or 1-800-FDA-1088

Please see important medication guide on adjoining page.

**AMBIEN<sup>CR</sup>**  
[ZOPIDEM TARTRATE EXTENDED RELEASE]   
6.25-MG & 12.5-MG EXTENDED RELEASE TABLETS



## MEDICATION GUIDE

**AMBIEN CR®** (ām'bē-ən see ahr) **C-IV**  
(*zolpidem tartrate extended-release tablets*)

Read the Medication Guide that comes with AMBIEN CR before you start taking it and each time you get a refill. There may be new information. This Medication Guide does not take the place of talking to your doctor about your medical condition or treatment.

### **What is the most important information I should know about AMBIEN CR?**

**After taking AMBIEN CR, you may get up out of bed while not being fully awake and do an activity that you do not know you are doing. The next morning, you may not remember that you did anything during the night.** You have a higher chance for doing these activities if you drink alcohol or take other medicines that make you sleepy with AMBIEN CR. Reported activities include:

- driving a car ("sleep-driving")
- making and eating food
- talking on the phone
- having sex
- sleep-walking

**Call your doctor right away if you find out that you have done any of the above activities after taking AMBIEN CR.**

### **Important:**

#### **1. Take AMBIEN CR exactly as prescribed**

- Do not take more AMBIEN CR than prescribed.
- Take AMBIEN CR right before you get in bed, not sooner.

#### **2. Do not take AMBIEN CR if you:**

- drink alcohol
- take other medicines that can make you sleepy. Talk to your doctor about all of your medicines. Your doctor will tell you if you can take AMBIEN CR with your other medicines.
- cannot get a full night's sleep

### **What is AMBIEN CR?**

AMBIEN CR is a sedative-hypnotic (sleep) medicine. AMBIEN CR is used in adults for the treatment of a sleep problem called insomnia. Symptoms of insomnia include:

- trouble falling asleep
- waking up often during the night

AMBIEN CR is not for children.

AMBIEN CR is a federally controlled substance (C-IV) because it can be abused or lead to dependence. Keep AMBIEN CR in a safe place to prevent misuse and abuse. Selling or giving away AMBIEN CR may harm others, and is against the law. Tell your doctor if you have ever abused or have been dependent on alcohol, prescription medicines or street drugs.

### **Who should not take AMBIEN CR?**

Do not take AMBIEN CR if you are allergic to anything in it. See the end of this Medication Guide for a complete list of ingredients in AMBIEN CR.

**AMBIEN CR may not be right for you. Before starting AMBIEN CR, tell your doctor about all of your health conditions, including if you:**

- have a history of depression, mental illness, or suicidal thoughts
- have a history of drug or alcohol abuse or addiction
- have kidney or liver disease
- have a lung disease or breathing problems
- are pregnant, planning to become pregnant, or breastfeeding

Tell your doctor about all of the medicines you take including prescription and nonprescription medicines, vitamins and herbal supplements. Medicines can interact with each other, sometimes causing serious side effects. **Do not take AMBIEN CR with other medicines that can make you sleepy.**

Know the medicines you take. Keep a list of your medicines with you to show your doctor and pharmacist each time you get a new medicine.

### **How should I take AMBIEN CR?**

- Take AMBIEN CR exactly as prescribed. Do not take more AMBIEN CR than prescribed for you.
- **Take AMBIEN CR right before you get into bed.**
- **Do not take AMBIEN CR unless you are able to stay in bed a full night (7-8 hours) before you must be active again.**
- Swallow AMBIEN CR Tablets whole. Do not chew or break the tablets. Tell your doctor if you cannot swallow tablets whole.
- For faster sleep onset, AMBIEN CR should NOT be taken with or immediately after a meal.
- Call your doctor if your insomnia worsens or is not better within 7 to 10 days. This may mean that there is another condition causing your sleep problems.
- If you take too much AMBIEN CR or overdose, call your doctor or poison control center right away, or get emergency treatment.

### **What are the possible side effects of AMBIEN CR?**

#### **Serious side effects of AMBIEN CR include:**

- **getting out of bed while not being fully awake and do an activity that you do not know you are doing.** (See "What is the most important information I should know about AMBIEN CR?")
- **abnormal thoughts and behavior.** Symptoms include more outgoing or aggressive behavior than normal, confusion, agitation, hallucinations, worsening of depression, and suicidal thoughts or actions.
- **memory loss**
- **anxiety**
- **severe allergic reactions.** Symptoms include swelling of the tongue or throat, trouble breathing, and nausea and vomiting. Get emergency medical help if you get these symptoms after taking AMBIEN CR.



**Call your doctor right away if you have any of the above side effects or any other side effects that worry you while using AMBIEN CR.**

**The most common side effects of AMBIEN CR are:**

- headache
- sleepiness
- dizziness
- You may still feel drowsy the next day after taking AMBIEN CR. **Do not drive or do other dangerous activities after taking AMBIEN CR until you feel fully awake.**

**After you stop taking a sleep medicine,** you may have symptoms for 1 to 2 days such as: trouble sleeping, nausea, flushing, lightheadedness, uncontrolled crying, vomiting, stomach cramps, panic attack, nervousness, and stomach area pain. These are not all the side effects of AMBIEN CR. Ask your doctor or pharmacist for more information. Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

**How should I store AMBIEN CR?**

- Store AMBIEN CR at room temperature, 59° to 77°F (15° to 25° C).
- **Keep AMBIEN CR and all medicines out of reach of children.**

**General Information about AMBIEN CR**

- Medicines are sometimes prescribed for purposes other than those listed in a Medication Guide.
- Do not use AMBIEN CR for a condition for which it was not prescribed.
- Do not share AMBIEN CR with other people, even if you think they have the same symptoms that you have. It may harm them and it is against the law.

This Medication Guide summarizes the most important information about AMBIEN CR. If you would like more information, talk with your doctor. You can ask your doctor or pharmacist for information about AMBIEN CR that is written for healthcare professionals. For more information about AMBIEN CR, call 1-800-633-1610 or visit [www.ambienr.com](http://www.ambienr.com).

**What are the ingredients in AMBIEN CR?**

**Active Ingredient:** Zolpidem tartrate

**Inactive Ingredients:** The 6.25 mg tablets contain: colloidal silicon dioxide, hypromellose, lactose monohydrate, magnesium stearate, microcrystalline cellulose, polyethylene glycol, potassium bitartrate, red ferric oxide, sodium starch glycolate, and titanium dioxide. The 12.5 mg tablets contain: colloidal silicon dioxide, FD&C Blue #2, hypromellose, lactose monohydrate, magnesium stearate, microcrystalline cellulose, polyethylene glycol, potassium bitartrate, sodium starch glycolate, titanium dioxide, and yellow ferric oxide.

**Rx Only**

This Medication Guide has been approved by the U.S. Food and Drug Administration.

sanofi-aventis U.S. LLC

Bridgewater, NJ 08807

January 2008a

AMBCR-JAN08a-M-Ab



This Nebraska house sparrow's ancestors came from Europe.



**Sparrow Dive** House sparrows—native to Europe, Asia, and North Africa—are bound to humans. They eat our urban crumbs, nest under our eaves, and have followed us across the globe. But now their numbers are dropping—maybe because of us. In western Europe, changes in agricultural practices a few decades ago meant fewer stray seeds and weeds, and a decline in rural sparrows. Then some city populations started falling. In London, where the Royal Society for the Protection of Birds and many bird enthusiasts have studied the issue intensely, a 1925 survey counted 2,603 house sparrows in the city's Kensington Gardens; a follow-up in 2000 found only 8. A recent Royal Society study says sparrows aren't catching enough insects to feed their summer hatchlings. Some conservationists wonder if more pavement and less greenery are the culprits. —*Helen Fields*





**We come together to help local businesses succeed.** Every CITGO station is locally owned and independently operated. And together we provide a reliable source of fuel that helps neighborhood businesses succeed. CITGO receives crude oil from the wellhead in Venezuela to the U.S. coast in days as opposed to weeks, ensuring a steady supply of energy for local economies. It's just one more way the people of CITGO are there for you at every turn.

THERE AT EVERY TURN.





**Dead in the Water** It forms each spring and hits its lethal peak in summer—a blighted, oxygen-starved patch of the Gulf of Mexico. “Dead zones” occur around the world, from the Chesapeake Bay to the Baltic Sea. The biggest culprit? Agricultural runoff. In this case, fertilizer from upstream fields runs down the Mississippi River to the Gulf, where it spurs algae blooms. When the algae die (or are eaten and egested by zooplankton), they decompose on the bottom, depleting the oxygen, suffocating sea life—and hurting livelihoods. Clint Guidry, a Louisiana shrimper, says, “People can’t imagine how much marine life this is killing.” Last year’s dead zone was the third largest since monitoring began in the 1980s, but 2008’s could top it: The push for ethanol fuel means farmers are planting more corn, a crop often heavily fertilized. —Chris Carroll



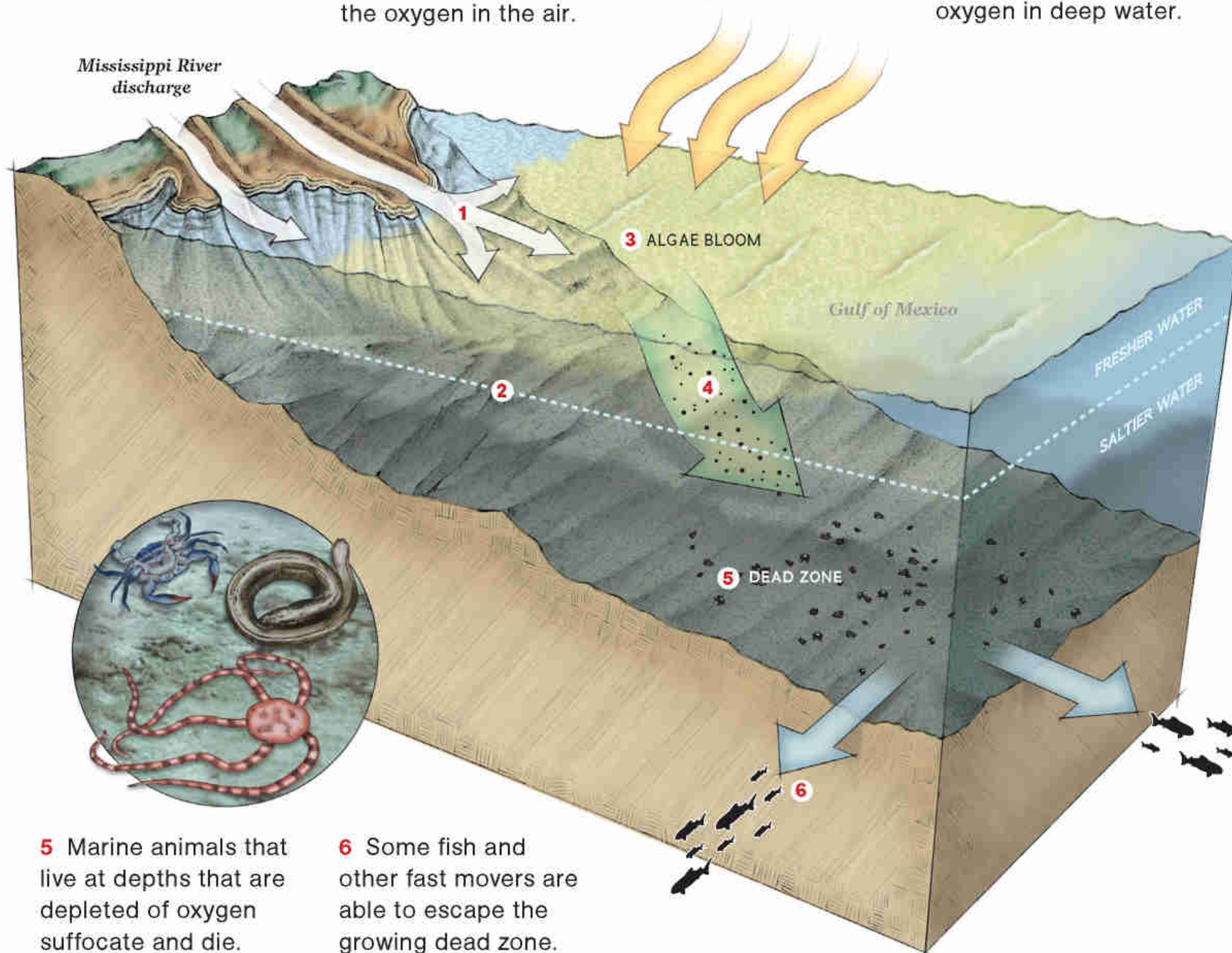
## HOW THE DEAD ZONE KILLS

**1** Fertilizer and other compounds empty from the Mississippi River into Gulf waters.

**2** In spring, freshwater runoff creates a barrier layer, cutting off the salt water below from the oxygen in the air.

**3** Problem: Various fertilizers and the warming waters cause an algae bloom.

**4** Dead algae sink to the bottom and are decomposed by bacteria, depleting the oxygen in deep water.

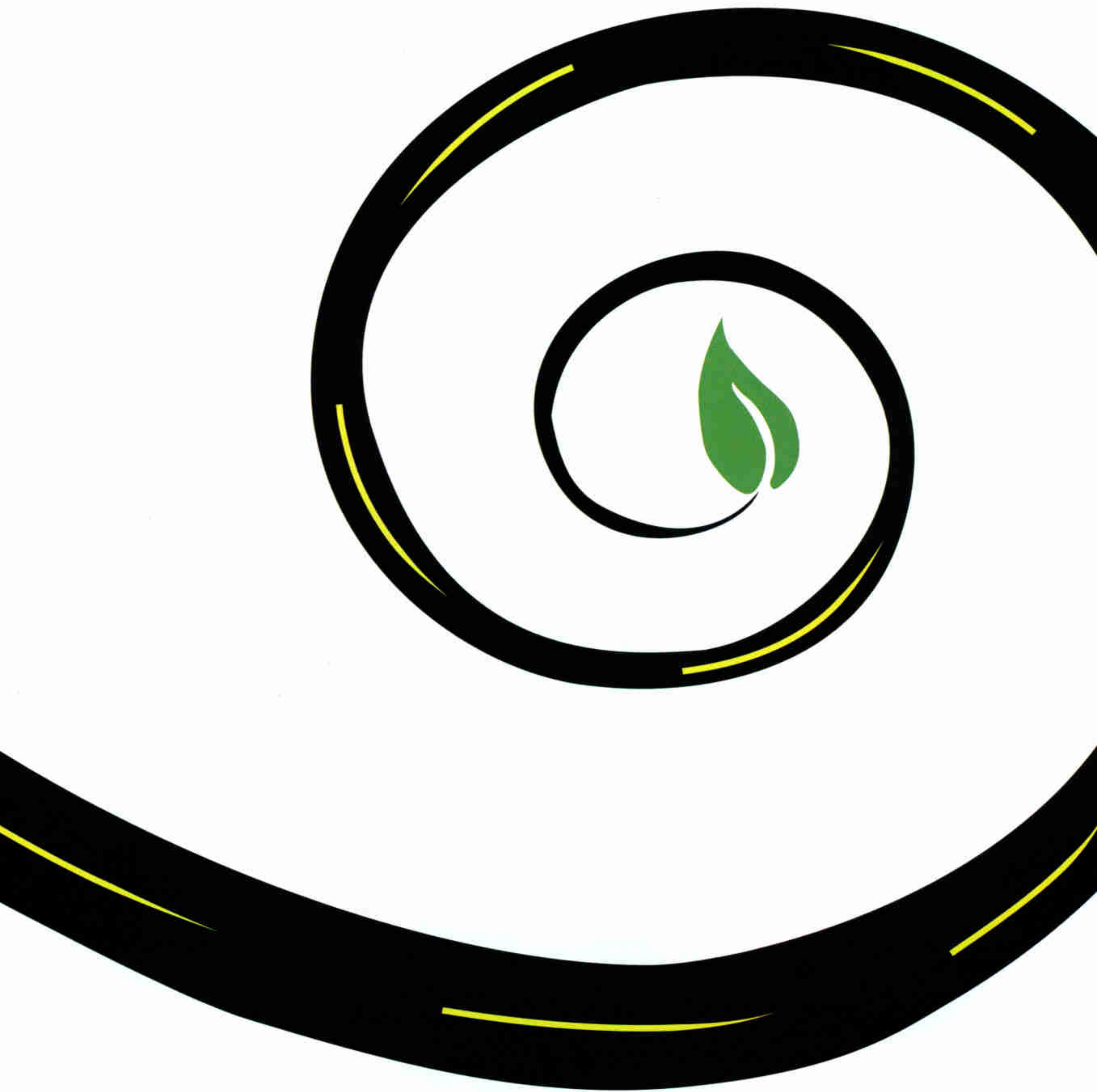


**5** Marine animals that live at depths that are depleted of oxygen suffocate and die.

**6** Some fish and other fast movers are able to escape the growing dead zone.



Where does the future<sup>e</sup> lead?

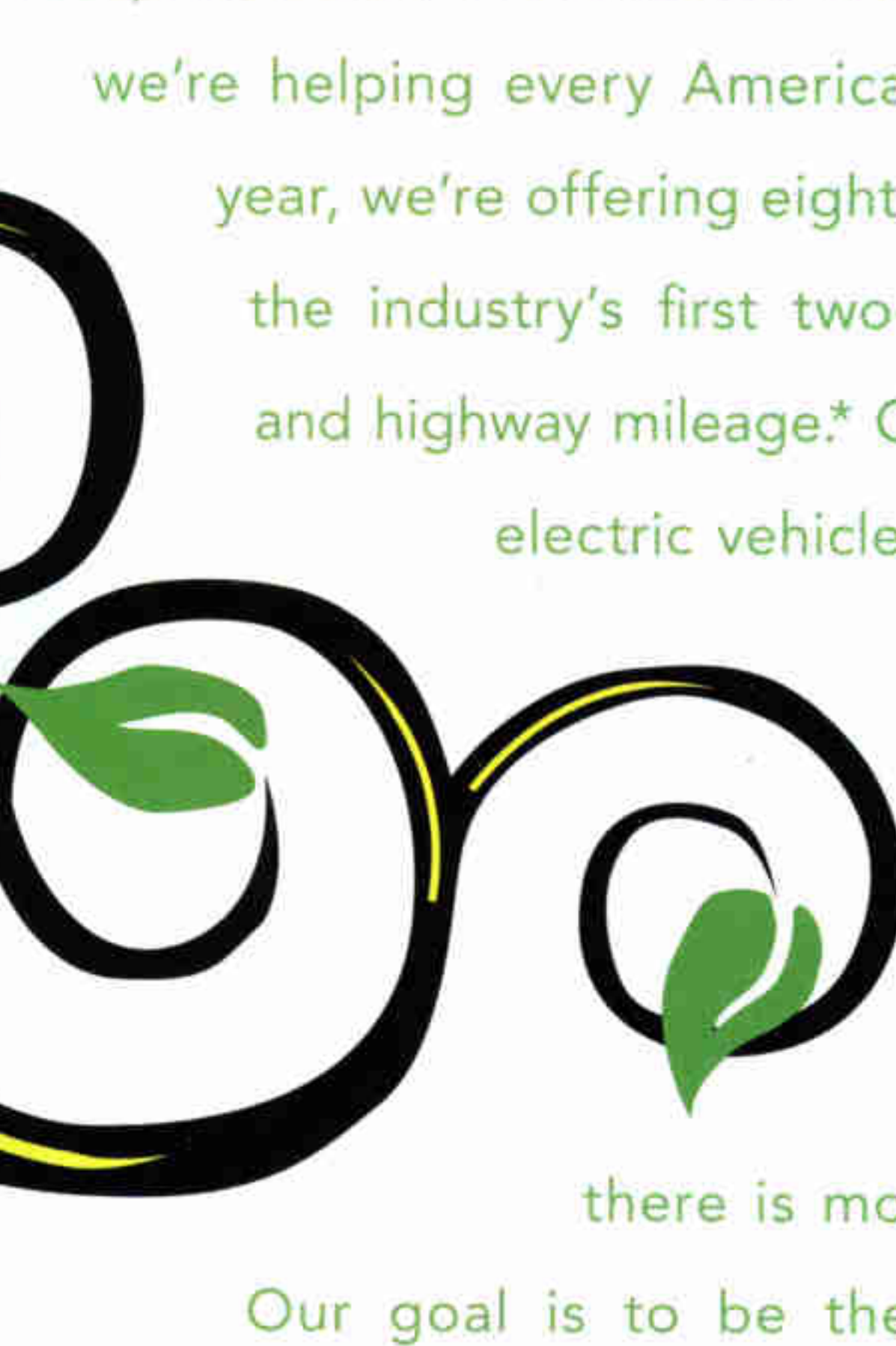








## our e-mission



At General Motors, our commitment to the environment extends well beyond the road. We're not just improving the cars you drive, we're improving the way we build them. Our facilities worldwide recycle 89% of the waste they generate. Fourteen of our plants have achieved zero landfill status. And today, GM is one of the world's largest industrial users of solar power. While increasing our global sales and manufacturing footprint to their highest levels ever, we've lowered our carbon footprint below 1990s levels. We're reducing it more every day and now we're helping every American do the same. In the 2008 calendar year, we're offering eight hybrid cars, trucks and SUVs, including the industry's first two-mode hybrid that increases both city and highway mileage.\* Our concept Chevy Volt extended-range electric vehicle — designed to give 78% of Americans a gas-free commute — is creating quite a buzz as it gets closer.\*\* And right now across America, we're testing the world's largest fleet of hydrogen vehicles†. At GM, we believe there is more than one way to get to the future. Our goal is to be the car company that takes you there.



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\*Based on EPA estimated mpg 14 city/19 hwy for the 2008 Yukon/Tahoe 2WD with Vortec 5.3L engine. Yukon/Tahoe Hybrid 2WD with EPA estimated 21 mpg city/22 mpg hwy. \*\*Source: Vol. 3, Issue 4, Oct. 2003 Omnistats—U.S. Dept. of Transportation, Bureau of Transportation Statistics. †Not available for sale.


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THE ASPEN INSTITUTE AND  
NATIONAL GEOGRAPHIC MAGAZINE

# ASPEN

## ENVIRONMENT FORUM



## The Aspen Environment Forum Offers Up Some Big Ideas

***But Are Consumers Willing To Do Their Part?***

It was over three days chock-full of insightful, compelling ideas and camaraderie. In an effort to stimulate thinking on the future of our environment and the world's growing energy crisis, a diverse group of attendees gathered to participate in a rich exchange during a weekend forum in Aspen, Colorado. Hosted by the Aspen Institute—an international nonprofit dedicated to fostering leadership and open-minded dialogue—and *National Geographic* magazine, the first ever Aspen Environment Forum convened at the Institute's Aspen campus on March 26–30. Part convocation, part round-table, and part local town meeting, leading scientists, activists, journalists, politicians, historians, educators, business leaders, and the public had the opportunity to discuss a variety of interrelated environmental issues, such as energy conservation, climate change, environmental policy, and new technologies. And while everyone agrees there's no shortage of problems, the Forum presented a host of workable solutions. According to Princeton scientists Stephen Pacala and Robert Socolow, "Humanity already possesses the fundamental scientific, technical, and industrial know-how to solve the carbon and climate problem for the next half century." The real question is, do we have the will?



### The Aspen Environment Forum's "Pledge"

The Aspen Institute and *National Geographic* magazine encouraged Forum participants to lead by example while upholding the ideas shared at sessions. To do their part to help reduce the environmental footprint of the event, the organizers of the Forum teamed with the city of Aspen to reduce waste, recycle, and offset the carbon emissions that Forum attendees were estimated to produce through air travel, ground transportation, and the use of facilities in Aspen. Attendees were encouraged to use the city's Canary Tag program, a voluntary carbon-offset program that generates funding for local, state, and regional programs that work to reduce greenhouse gases. Attendees and participants could calculate the size of their footprint by using the city's carbon calculator, located on [canarytags.com](http://canarytags.com).



## Scenes From a Changing Planet

The Forum was thematically divided by day. Day one, Scenes From a Changing Planet, started with presentations of the latest information, data, and theories about the current state of the environment. Legendary Harvard biologist and Pulitzer Prize-winning author, E. O. Wilson, spoke of our obligation to preserve entire ecosystems as opposed to individual species. Through his project "The Extreme Ice Survey," photographer James Balog shared an unprecedented look at retreating glaciers. Daniel Nocera, a professor of energy at MIT, described an achievable energy future—if the world seriously pursued scientific, technological, and policy advances needed to make sunlight into usable energy.

Day two, Questions, Limits, and Challenges, identified areas that deserved a closer look in our shared environment, such as access to fresh water

and the availability of clean sources of energy. Topics included sustainable business practices, the challenges of population growth, and creating the political will for change that finds the right balance between regulation and incentive. According to Lester Brown, founder of the Earth Policy Institute, "saving civilization is not a spectator sport" and will require a "wartime mobilization" to reduce greenhouse gas emissions.

## Environmentally Sustainable Solutions

The final day was devoted to examining the best current examples of alternatives that are working. The ideas that were discussed ran the gamut: using artificial photosynthesis to supply our energy needs, alternative energy options such as wind farms in wheat

fields, oil-saving solutions (manufacture planes, cars, and trucks out of a superstrong, superlight composite material to save more than eight million barrels of oil per day), and rethinking cities (create urban planning policies that will promote better housing, transportation, and economic development that leads to environmental preservation).

Highlights of the day included presentations by Majora Carter, founder and executive director of Sustainable South Bronx, and Van Jones, president and co-founder of Ella Baker Center for Human Rights. They discussed a new campaign to bring "green-collar" jobs to urban areas. Abby Joseph Cohen, president of the Goldman Sachs Global Market Institute, demonstrated how public-private alliances could serve as a new model for conservation. Cheryl Rogowski, an organic farmer, shared





her vision for a new future of food where Community Supported Agriculture programs (CSAs) when partnered with HMOs, encourage sustainable farming, local profits, and better health. Beth Lowery, vice president for environment, energy, and safety policy at General Motors, said that petroleum dependency isn't good for business, the environment, or society. During her presentation, Lowery echoed a recurring theme at the Forum: We cannot force technology on people. If people are not willing to buy a product, if it is unaffordable, or if we don't give them the right sources of fuel, we won't be doing a thing to reduce carbon overall. She said, for GM, the key is having a diverse array of products so there is something for every consumer who wants to do the right thing, and there's a new transparency at the company that brings consumers along in the product development process by sharing new technologies as they are being created.

## Collective Will

Needless to say, thousands of ideas were exchanged during the weekend. While there are no silver bullets, the prevailing final thoughts were that the world will not be saved by any one organization. In the last session of the weekend, the

Aspen Institute's prestigious Catto Fellows—a group of 20 emerging leaders from around the world—discussed the role all parts of society play in creating a clean-energy economy. Government initiatives, NGOs, and private-sector organizations like oil and automotive companies will wield real power in counter-acting the effects of global warming by bringing products and services to market that people will actually buy. But that's only half the battle. When those products get to market, private citizens have to do their part and embrace them.

When photographer and Extreme Ice Survey founder James Balog finished his presentation, he put forth a question his young daughter had asked him: "Daddy, what were YOU doing when you realized the planet was changing?" Balog does his part by using his skills and the tools available to him to share the story of the melting glaciers. Wouldn't it be wonderful if each of us could point to something we are doing too?



## General Motors: One of the Forum's Sponsors, Responds to the Challenge

Through a journey that's well under way, General Motors is committed to a simple environmental mission: Take America from gas-friendly to gas-free. The company has made a profound investment in the environment. Today GM offers the most models that get an EPA-estimated 30 mpg or better on the highway. GM has more than three million FlexFuel vehicles on the road today capable of running on E85 ethanol, which burns cleaner than gasoline. And GM has eight different hybrid cars, trucks, and SUVs planned for the 2008 calendar year. The new concept Chevy Volt, an extended-range electric vehicle—designed to give 78% of Americans a gas-free commute—is creating a big buzz not only in the auto industry, but also among eco-conscious people in the know. Plus, GM is testing the world's largest fleet of hydrogen fuel-cell vehicles in Los Angeles, New York, and Washington, D.C.

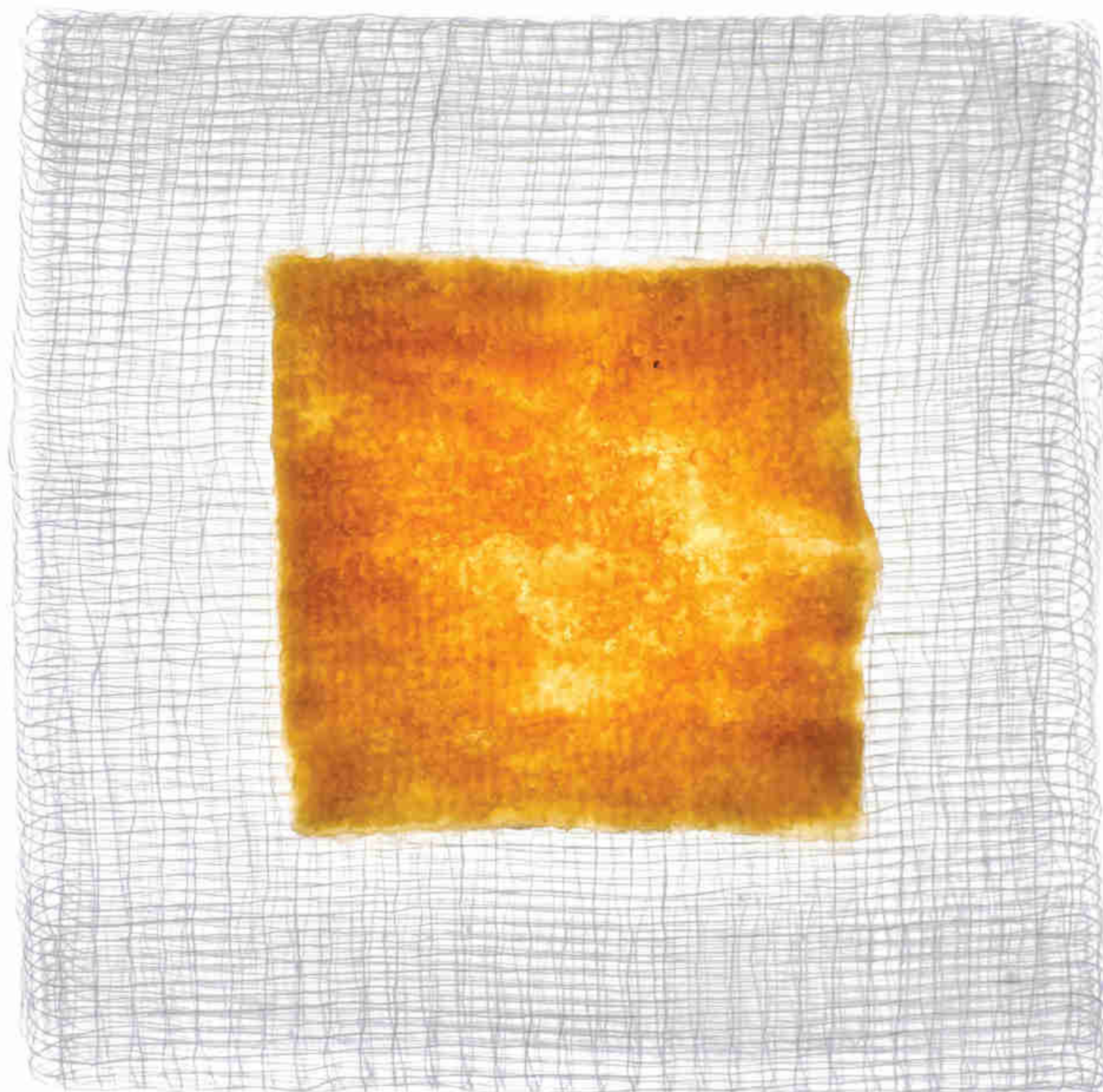


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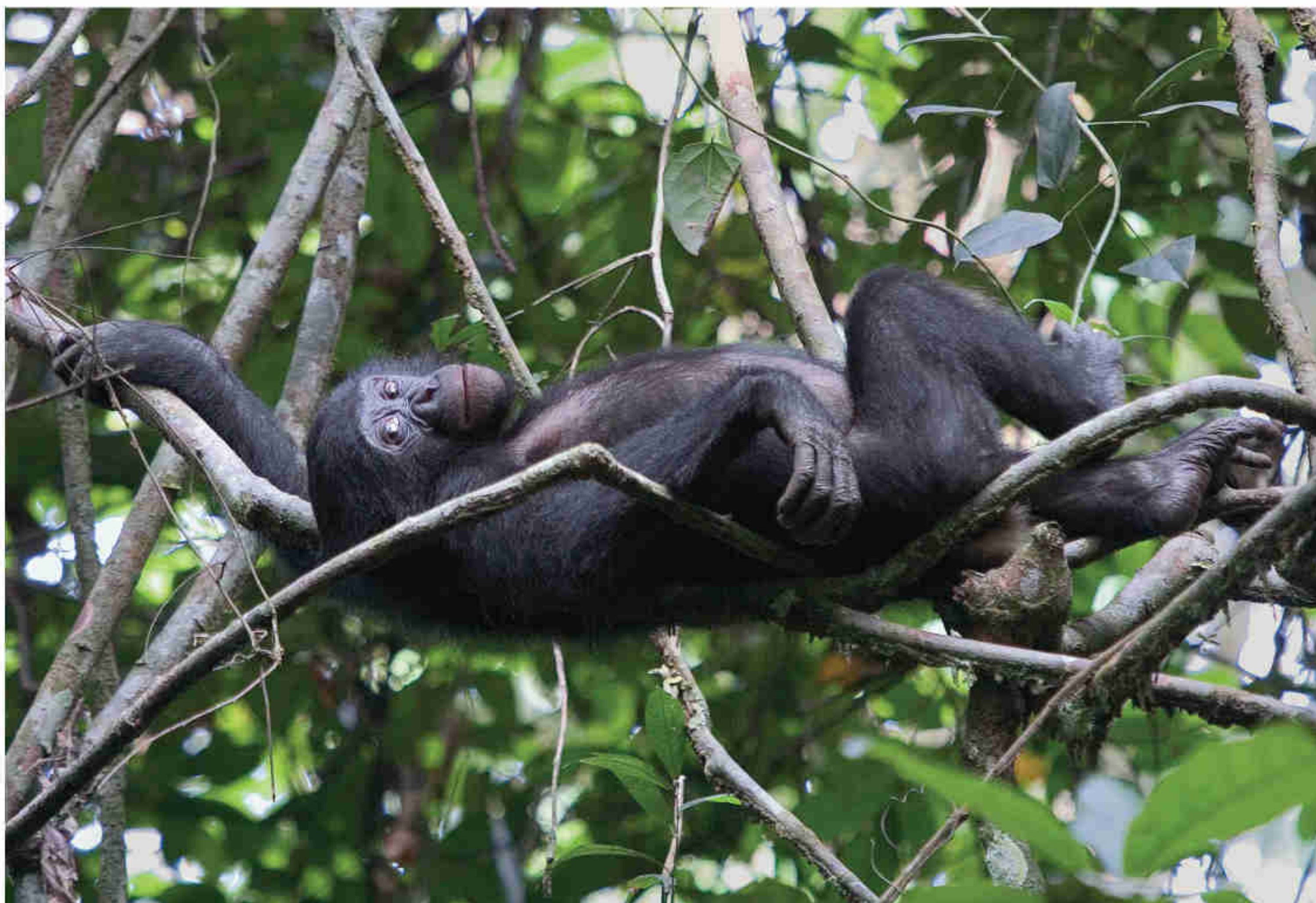




Wound and burn centers in many countries use the two-inch-square manuka honey bandage, here backed by gauze.

**Sweet Fix** As bacteria grow increasingly resistant to antibiotics, doctors around the world are rediscovering an old ally: honey. A popular medicine before the era of modern wonder drugs, honey fights bacteria in wounds in several ways, including the steady production of hydrogen peroxide, an antiseptic. For several years hospitals in Asia and Europe have been using bandages infused with an unusually potent honey from the manuka trees of New Zealand, and now U.S. and Canadian institutions are following their lead. The antiseptic strength of each batch's magic bullet—called the Unique Manuka Factor—is rated from zero to 25. Scientists still haven't fully identified which of more than a hundred possible substances packs the powerhouse punch, but its presence means there's a good chance the honey will stick as a treatment. —A. R. Williams





Similar in size to a chimpanzee, a bonobo stretches out in the canopy to eat.

**NG GRANT A Boon for Bonobos** In the great ape family, bonobos are the cheeky, easy-going members. Not for them aggressive, chest-pounding displays of dominance. They are lovers, seldom fighters. In their female-dominated societies, individuals copulate to settle conflicts. Bonobos also engage in communal sex to ease strains at a new feeding site.

To help save this singular and endangered primate, found only in the rain forests of the Democratic Republic of the Congo, the DRC government and U.S.-based Bonobo Conservation Initiative have created a vast sanctuary. Larger than the state of Massachusetts, the 11,803-square-mile Sankuru Nature Reserve likely harbors several thousand bonobos out of an estimated population of 50,000. (Numbers are inexact, as a decade of civil war has kept researchers out of the area.) To make the reserve work, local communities have vowed to stop killing bonobos for meat, the chief threat, in return for development aid. Sankuru is the first part in a network of planned reserves to be called the Bonobo Peace Forest. —Tom O'Neill





# Are You the “Ultimate” Photographer?

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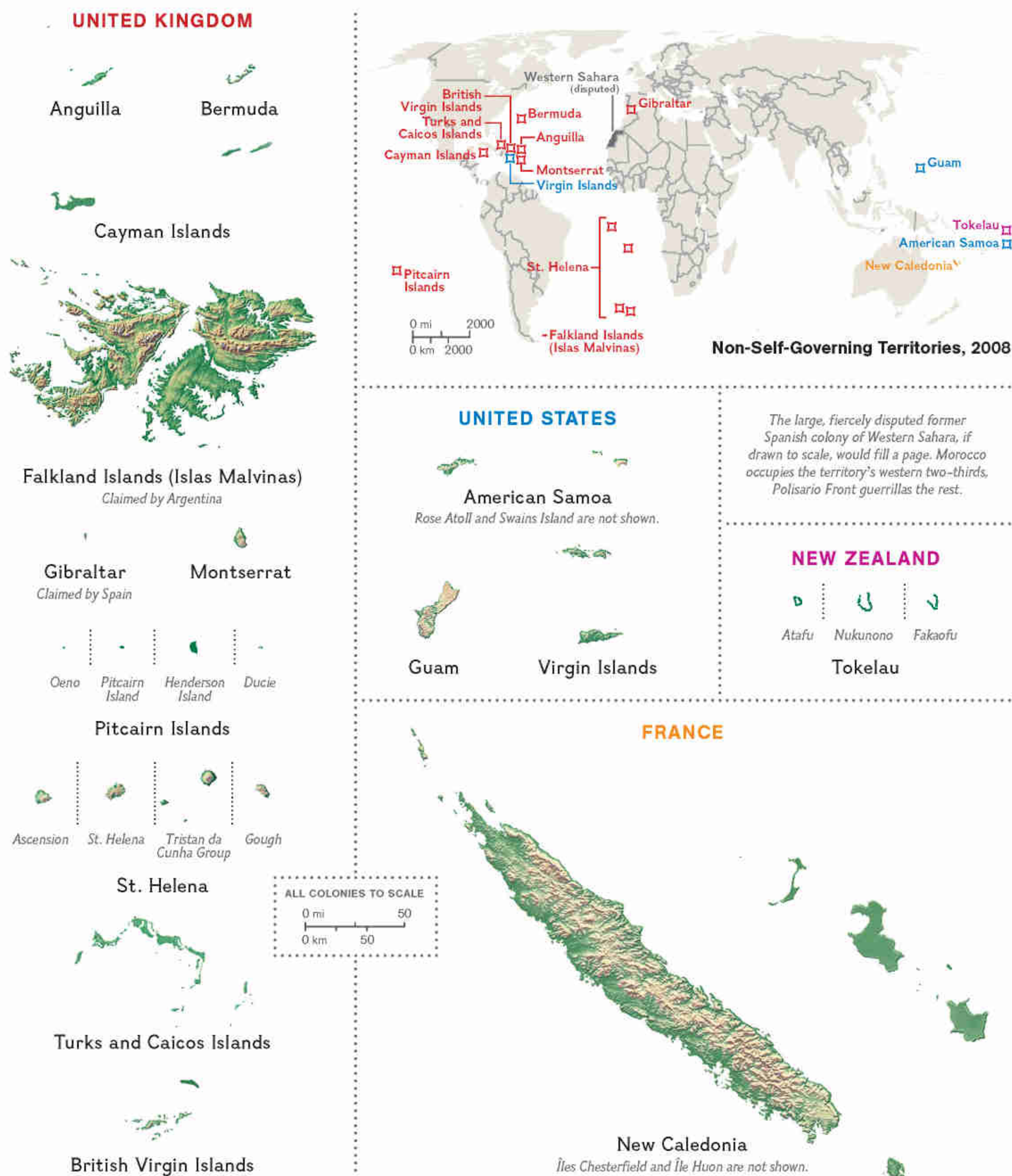
\*Vs. Energizer® MAX®. Results vary by camera.



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**Last Colonies** In 2002 East Timor won full independence from Indonesia. Since then no territory anywhere has achieved self-government. Nearly 50 years after the UN said colonialism must end, that organization lists 16 places, and two million people, still under foreign rule. Two colonial powers, the U.S. and the U.K., refuse to cooperate with the UN. France will let New Caledonia vote next decade on its future. And New Zealand urged Tokelau to choose equal partnership, but a 2007 referendum failed—by 16 votes. —Karen E. Lange





## DAVID DOUBILET

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# HISTORY

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As one of the world's treasure troves of history and culture, Peru delivers an endless panorama of amazing spectacles set amid breathtaking scenery. From the cultural riches of 500-year-old Lima and the magnificent Andean peaks to the jungles and thatched villages of the Amazon Basin, Peru offers sights that will be forever etched in the minds of those who travel there.



Machu Picchu, Carlos Sala/PromiPeru

## Ancient Cities

Peru's history stretches back thousands of years. Around A.D. 1000, the Chimú people built the city of **Chan Chan**. The extensive ruins of this largest mud city in the world, located near the coast, are a must-see for archaeology buffs. Some 400 years later, the Chimú gave way to an even greater civilization, that of the

**Inca**. The vast and prosperous Inca Empire flourished to become South America's most magnificent pre-Columbian culture, with unprecedented achievements in architecture, astronomy, roadbuilding, and lawmaking.

Lured by tales of gold, Spanish explorer Francisco Pizarro conquered Peru and the Incas in the 1530s. Until Peruvian independence 300 years later, Spain ruled the country. The Spanish conquistadores, however, never found the fabled lost city of the Inca; it was later discovered in 1911. Today that mountain-cradled city, **Machu Picchu**, is one of the most breathtaking travel destinations on the planet.

Also not to be missed while in Peru: The verdant **Sacred Valley** and its constellation of fascinating towns and pre-Columbian ruins that spread to the southeast, and the nearby Inca capital, **Cusco**, which lies at an elevation of about 11,200 feet. Its cobblestone lanes wind past both colonial and Inca architecture—in some cases Catholic buildings were built onto Inca temples—a fascinating sight for any fan of architecture.

## Immerse Yourself in the Local Culture

Within a few hundred miles west-to-east, Peru's landscape changes from coastal desert to sparkling snowcapped mountains to lush rain forest. Along the coast, Peru's capital, **Lima**, holds numerous colonial-era works of architecture. High up in the Andes on the shores of **Lake Titicaca**, **Puno** the folklore capital of Peru, hosts many festivals, dances, and parades. And out in the jungle-thick **Madre de Dios** region, national parks harbor hundreds of plant and animal species.



Paracas Shroud, Wilfredo Loayza/PromiPeru

Descendants of the Inca, Peru's indigenous people continue to farm the highlands and fish the rain forest streams. The Amazon port city of **Iquitos**—not connected by road to the outside world—is a hub for exploring the jungle and many native villages, where some Indians still speak only Quechua.



# HE EMERGED FROM THE SEA AND BUILT ETERNAL WALLS.

His name was Tacaynamo and together with thousands of men, he worked the mud into a city. Almost 20 km. of walls and corridors disappear beyond the horizon, with the engravings on its surfaces being silent witnesses of the mystery that has kept them standing for centuries. This place exists. You can see it, touch it, feel it.

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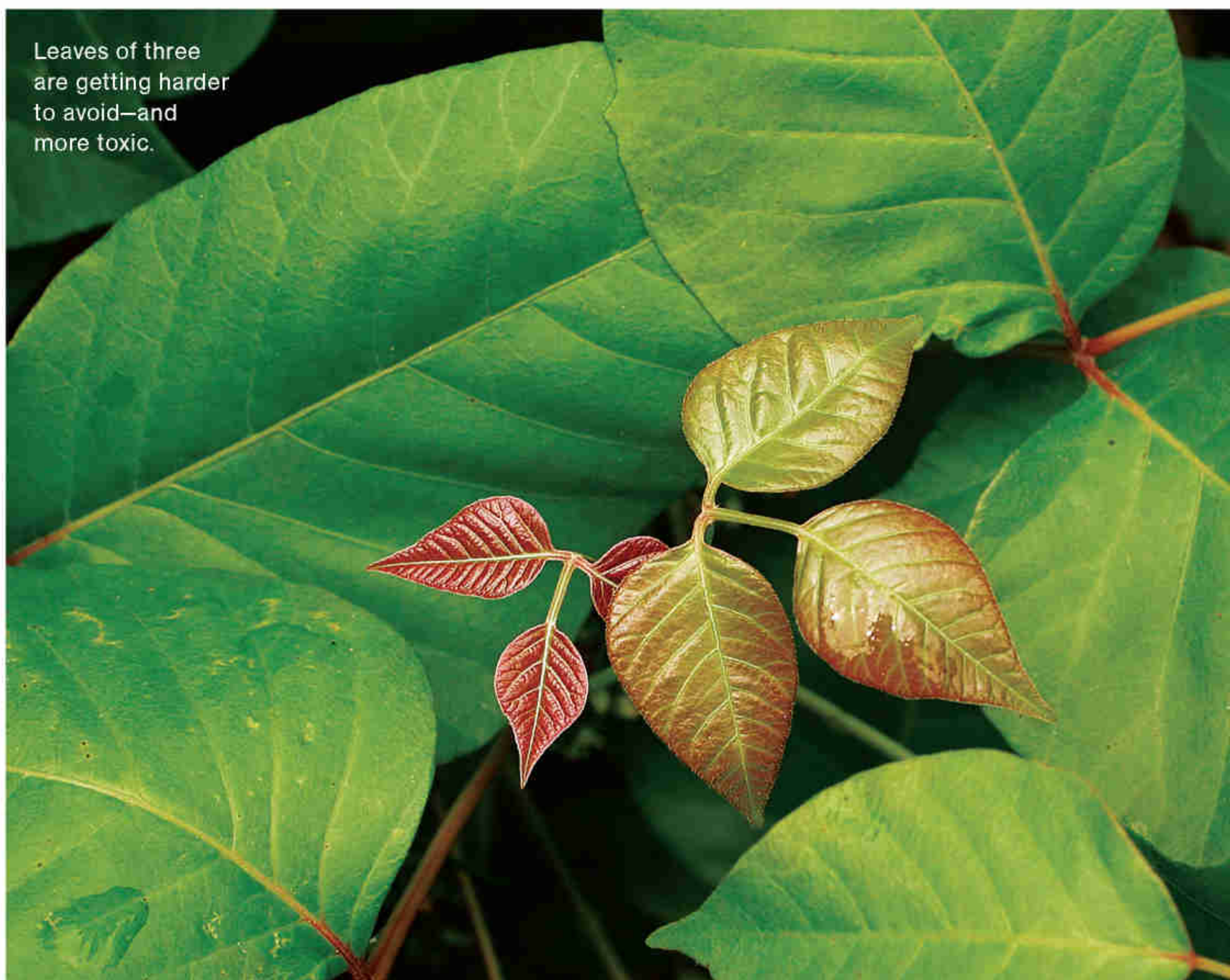


Chan Chan citadel is located 5 km away from the city of Trujillo.  
Visit: [www.peru.info](http://www.peru.info)





Leaves of three  
are getting harder  
to avoid—and  
more toxic.



**Extra-Itchy Ivy** The first time skin comes in contact with poison ivy's oil, usually no rash erupts. For most people, it takes a second exposure for the immune system to recognize the oil and blanket the skin with itchy, blistery bumps. About 85 percent of people exposed to poison ivy have this allergic reaction; each year more than ten million Americans develop a rash from poison ivy or related plants. Now scientists say poison ivy is becoming more plentiful and potent—and the global increase in carbon dioxide is to blame.

Carbon dioxide warms the Earth. It also acts like airborne fertilizer, pushing plants to photosynthesize more and grow faster. In USDA and Duke University experiments, poison ivy was grown in conditions mimicking past, present, and future atmospheres; it grew twice as big in today's carbon-rich air as in 1950-like conditions. This is a much larger increase than has been seen with other plants, says plant physiologist Lewis Ziska, maybe because viny ivy doesn't need to build a trunk. In the high-carbon air of the future, the plants made oil that was more allergenic, so Ziska says people who don't now react could begin to suffer. Ziska himself had plenty of rashes during the research. "I can only hope that next time," he says, "I get to work with strawberries." —Karen E. Lange

## DITCH THE ITCH

- **Avoid** Poison ivy can be shiny or dull, viny or not, but it almost always has three leaves.
- **Pre-apply** An over-the-counter cream can prevent itch-causing oil, urushiol, from penetrating skin.
- **Cleanup** Wash with soap and water to remove urushiol from skin, clothes, pets, and anything else.





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But still unchallenged.



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[MBUSA.com](http://MBUSA.com)



**A Cautionary Tail** Good soldiers and politicians understand that it's important to know your foe. So do squirrels. Some of them can even differentiate among types of snakes, and new research indicates that they tailor their tail work accordingly. When a snake comes crawling in search of lunch, a California ground squirrel raises its tail and jerks it side to side furiously—a process called tail-flagging—to thwart the predator.

And that's just the half of it. According to Aaron Rundus of the University of Nebraska-Lincoln, these squirrels know just when (and with whom) to kick it up a notch. If they're facing down northern Pacific rattlesnakes—pit vipers with infrared sensors on their faces that let them “see” body temperature—the squirrels add a dash of heat to their flagging, a message the rattlers get loud and clear. Snakes without the infrared equipment get a chillier reception—plenty of flagging, very little heat.

It's doubtful these squirrels learned a tail trick from their rattlesnake nemeses. But it's clear they're using their heads. —Sean McNaughton

## SEEING THE HEAT

Heat-sensitive facial pits (1) let rattlesnakes detect prey—and threats—from several feet away. Information from facial pits and the eyes (2) is processed in the same brain region (3), letting them “see” ground squirrels' body heat, perhaps as a brighter image.

### INFRARED IMAGES



For most types of snakes the squirrel keeps its tail cool.



But if a rattlesnake nears, the squirrel's tail heats up.





# Tomorrow begins today.



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## WHERE IN THE WORLD?



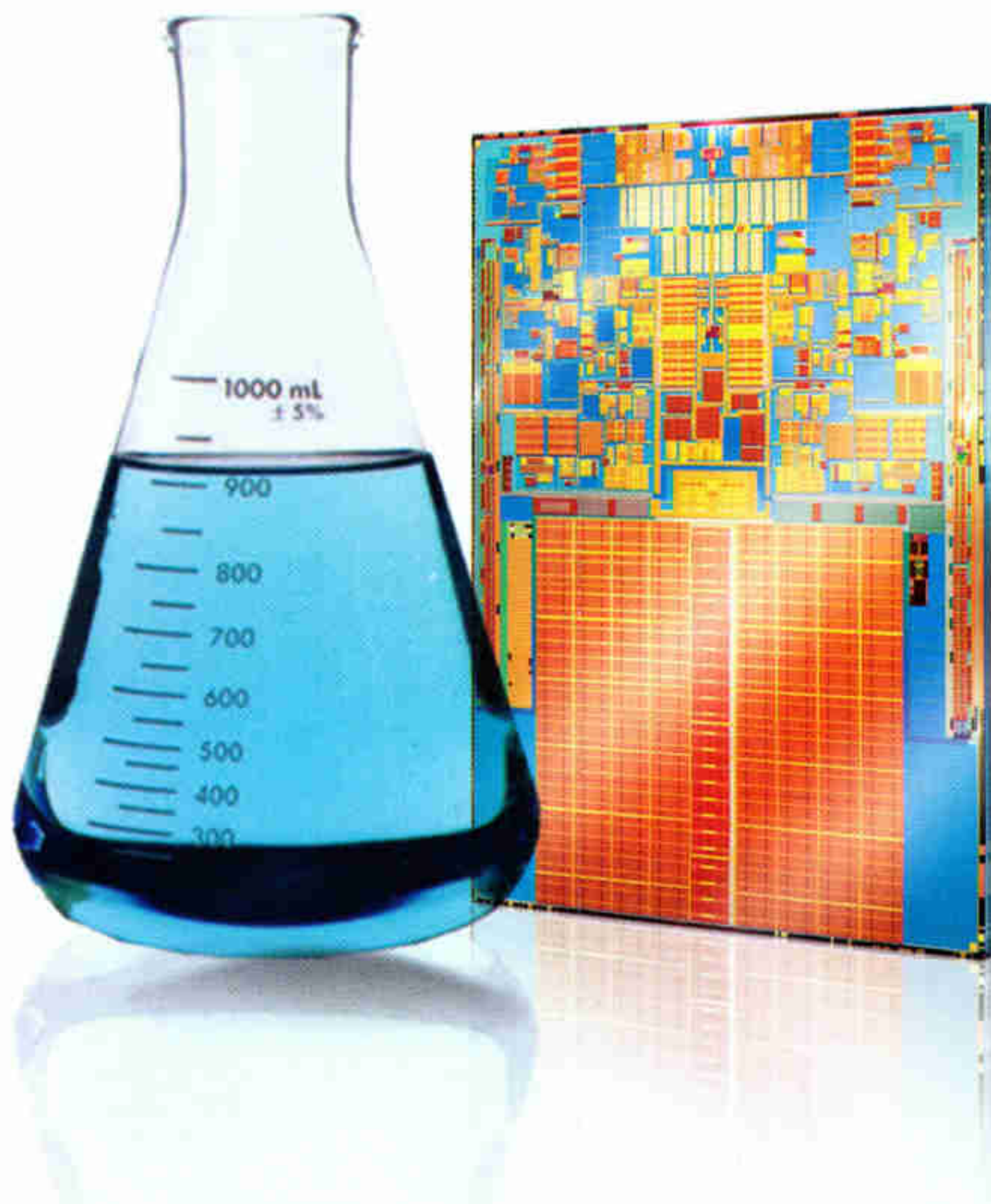
Polygonal patterns in Arctic permafrost range up to ten feet wide. Ice blocks wedged in the cracks are often hundreds of years old.

**Cold Canvas** With no soft, green cover, blunt cuts made by water and ice are visible on a delta beside the Rollrock River on Ellesmere Island in the Canadian High Arctic. In this frigid, arid landscape, cycles of freezing and thawing tear soil and stone into weird and wild patterns known as stripes, sorted circles, and pingos (an Inuit term used for earth-covered ice hills). The ice-wedge polygons pictured above begin forming when severe cold cracks the soil. In spring, water sluices into the cracks. Winter then freezes the water into ice wedges that drive the soil apart. —Neil Shea





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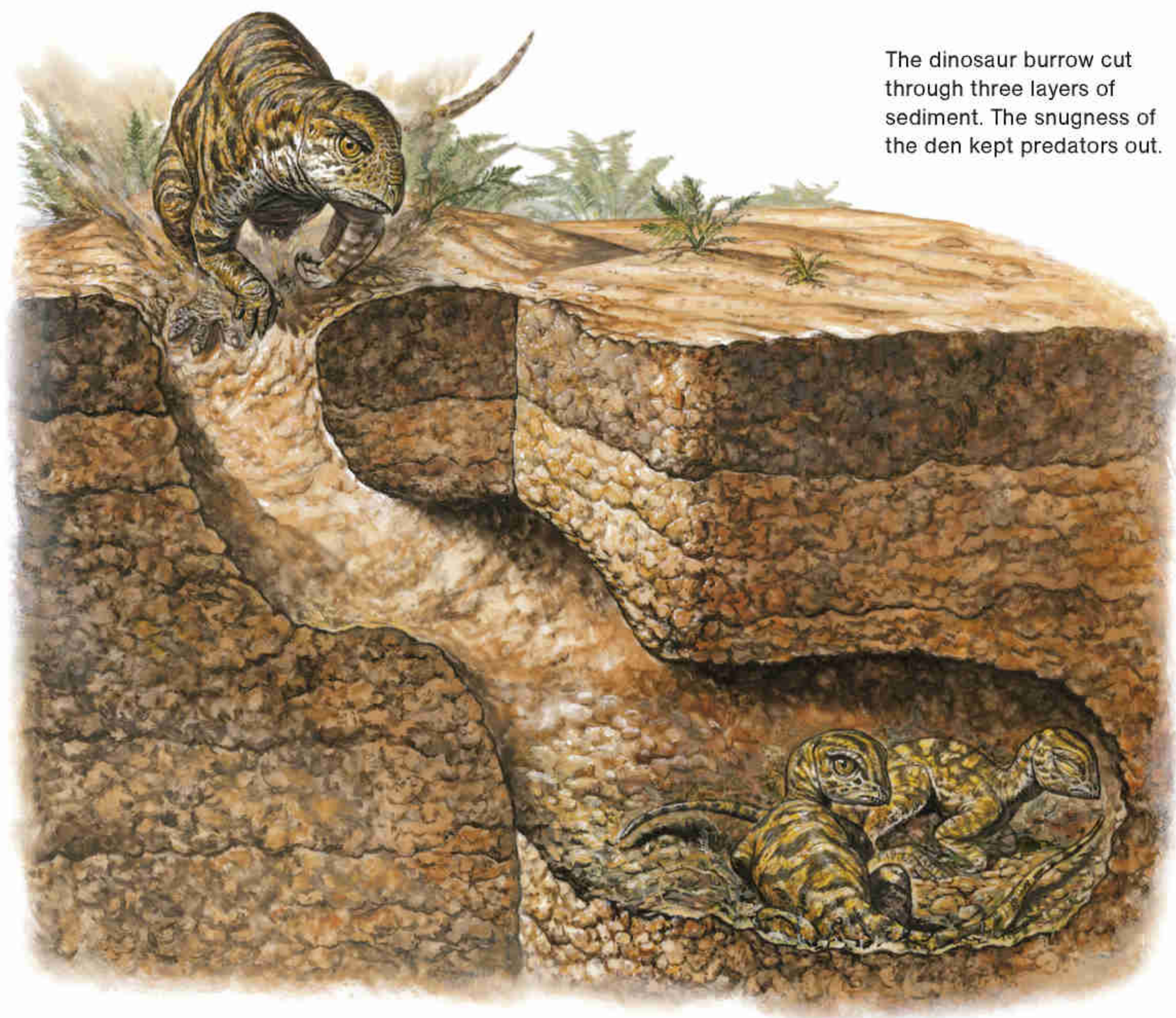
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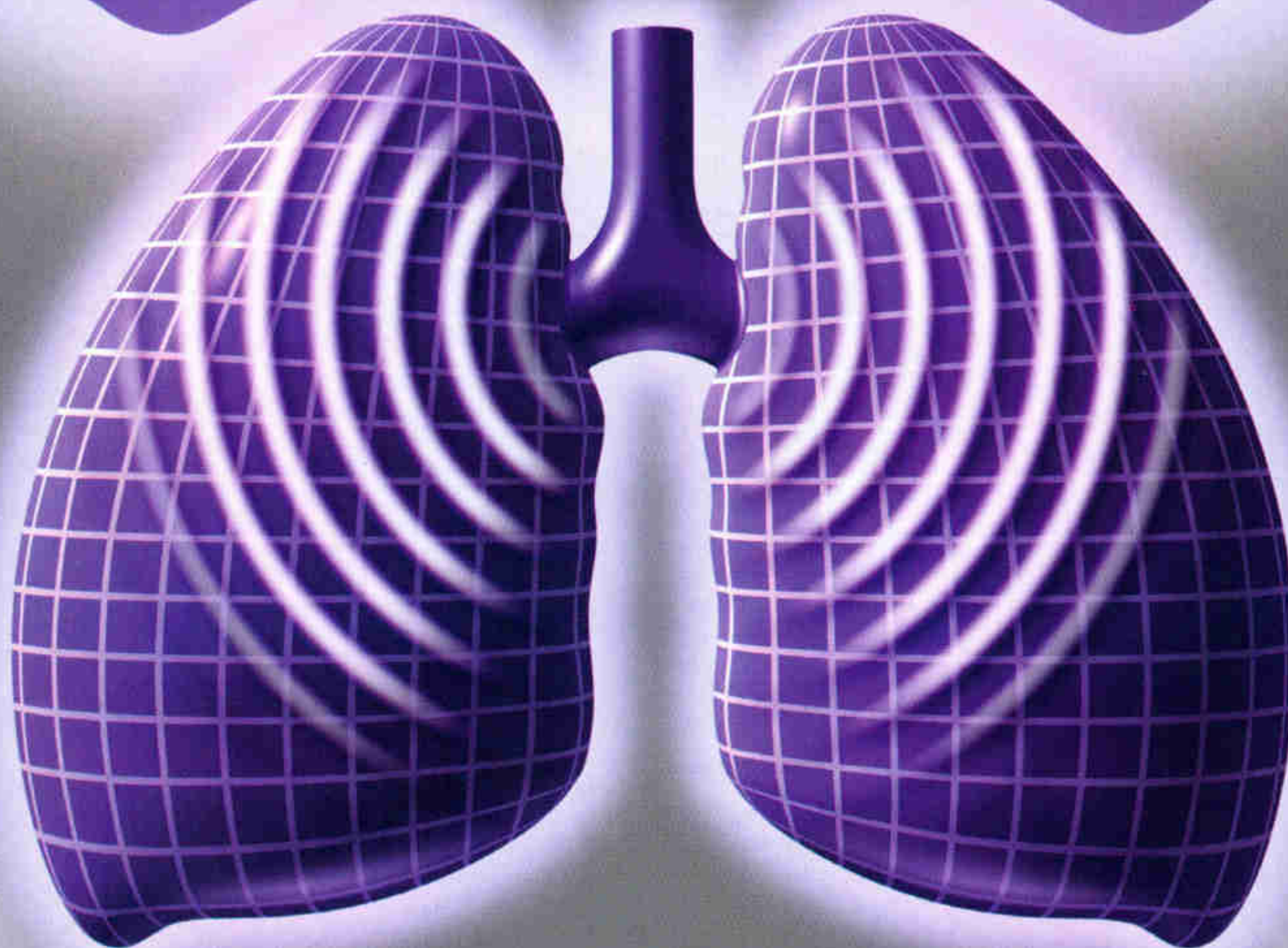


**Digging Dinosaurs** How did bantam dinosaurs escape the clutches of the ravenous brethren of *T. rex*? A few scientists speculated that some of them dug burrows, but no clear evidence emerged until paleontologist David Varricchio of Montana State University struck pay dirt in the state's Blackleaf formation. His team excavated a six-and-a-half-foot-long tunnel. At its end were the remains of a bathtub-size chamber holding fossils of an adult and two juvenile dinosaurs. Around 95 million years ago the burrow flooded, probably after the animals died, and filled with sand that eventually hardened to preserve the fossils and the burrow structure. Varricchio identified the fossils as a new species distantly related to duck-billed dinosaurs. The adult skeleton reveals a coyote-size herbivore that combined traits suited for digging—including robust shoulders and forelimbs—with hind legs adapted for bipedal running. Hence its name: *Oryctodromeus*, or digging runner. Its discovery may also shed light on how dinosaurs adapted to extreme environments. Now, says Varricchio, “we might expect to find burrowing dinosaurs in high latitudes or in deserts.” —Peter Gwin



The dinosaur burrow cut through three layers of sediment. The snugness of the den kept predators out.





## ADVAIR<sup>®</sup> helps significantly improve lung function so you can breathe better.\*

If you have COPD associated with chronic bronchitis, ADVAIR 250/50 may help. ADVAIR works differently than other COPD medications. It is the only product with an anti-inflammatory and a bronchodilator working together to help improve lung function. Talk to your doctor and find out if ADVAIR is right for you.



Get your first full prescription FREE.<sup>†</sup> Go to [advairCOPD.com](http://advairCOPD.com) or call 1-800-768-0200.

It is not known how anti-inflammatories work in COPD.

**Important Information:** ADVAIR DISKUS 250/50 is approved for controlling symptoms and preventing wheezing in adults with COPD associated with chronic bronchitis. The benefit of using ADVAIR DISKUS for longer than 6 months has not been evaluated. You should only take 1 inhalation of ADVAIR DISKUS 250/50 twice a day. Taking higher doses will not provide additional benefits but may increase your chance of certain side effects. Patients with COPD taking ADVAIR DISKUS may have a higher chance of pneumonia. Call your doctor if you notice any of the following symptoms: change in amount or color of sputum, fever, chills, increased cough, or increased breathing problems. Patients at risk for developing bone loss (osteoporosis) and some eye problems (cataracts or glaucoma) should be aware that use of inhaled corticosteroids, including ADVAIR DISKUS, may increase your risk. You should consider having regular eye exams. ADVAIR DISKUS does not replace fast-acting inhalers for acute symptoms.

\*Measured by a breathing test in people taking ADVAIR 250/50, compared with people taking either fluticasone propionate 250 mcg or salmeterol 50 mcg. Maximum effects may take several weeks. Your results may vary.

<sup>†</sup>See [advairCOPD.com](http://advairCOPD.com) for eligibility rules.  
Please see accompanying important information about ADVAIR DISKUS 250/50.

You are encouraged to report negative side effects of prescription drugs to the FDA.  
Visit [www.fda.gov/medwatch](http://www.fda.gov/medwatch), or call 1-800-FDA-1088.

**ADVAIR DISKUS<sup>®</sup> 250/50**  
(fluticasone propionate 250 mcg and salmeterol 50 mcg inhalation powder)



If you smoke and want to quit, you can learn more at [way2quit.com](http://way2quit.com).

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If you don't have prescription coverage and can't afford your medicines, visit [pparx.org](http://pparx.org), or call 1-888-4PPA-NOW (1-888-477-2669)



# ADVAIR DISKUS<sup>®</sup> 100/50, 250/50, 500/50 (fluticasone propionate 100, 250, 500 mcg and salmeterol 50 mcg inhalation powder)

## What is the most important information I should know about ADVAIR DISKUS?

In patients with asthma, long-acting beta<sub>2</sub>-agonist medicines such as salmeterol (one of the medications in ADVAIR<sup>®</sup>) may increase the chance of death from asthma problems. In a large asthma study, more patients who used salmeterol died from asthma problems compared with patients who did not use salmeterol. So ADVAIR is not for patients whose asthma is well controlled on another asthma controller medicine such as low- to medium-dose inhaled corticosteroids or only need a fast-acting inhaler once in a while. Talk with your doctor about this risk and the benefits of treating your asthma with ADVAIR.

ADVAIR should not be used to treat a severe attack of asthma or chronic obstructive pulmonary disease (COPD) requiring emergency medical treatment.

ADVAIR should not be used to relieve sudden symptoms or sudden breathing problems. Always have a fast-acting inhaler with you to treat sudden breathing difficulty. If you do not have a fast-acting inhaler, contact your doctor to have one prescribed for you.

## What is ADVAIR DISKUS?

There are two medicines in ADVAIR: Fluticasone propionate, an inhaled anti-inflammatory belonging to a group of medicines commonly referred to as corticosteroids; and salmeterol, a long-acting, inhaled bronchodilator belonging to a group of medicines commonly referred to as beta<sub>2</sub>-agonists. There are 3 strengths of ADVAIR: 100/50, 250/50, 500/50.

### For Asthma

- ADVAIR is approved for the maintenance treatment of asthma in patients 4 years of age and older. ADVAIR should only be used if your doctor decides that another asthma controller medicine alone does not control your asthma or that you need 2 asthma controller medications.
- The strength of ADVAIR approved for patients ages 4 to 11 years who experience symptoms on an inhaled corticosteroid is ADVAIR DISKUS 100/50. All 3 strengths are approved for patients with asthma ages 12 years and older.

### For COPD associated with chronic bronchitis

ADVAIR 250/50 is the only approved dose for the maintenance treatment of airflow obstruction in patients with COPD associated with chronic bronchitis. The benefit of using ADVAIR for longer than 6 months has not been evaluated. The way anti-inflammatories work in the treatment of COPD is not well defined.

## Who should not take ADVAIR DISKUS?

You should not start ADVAIR if your asthma is becoming significantly or rapidly worse, which can be life threatening. Serious respiratory events, including death, have been reported in patients who started taking salmeterol in this situation, although it is not possible to tell whether salmeterol contributed to these events. This may also occur in patients with less severe asthma.

You should not take ADVAIR if you have had an allergic reaction to it or any of its components (salmeterol, fluticasone propionate, or lactose). Tell your doctor if you are allergic to ADVAIR, any other medications, or food products. If you experience an allergic reaction after taking ADVAIR, stop using ADVAIR immediately and contact your doctor. Allergic reactions are when you experience one or more of the following: choking; breathing problems; swelling of the face, mouth and/or tongue; rash; hives; itching; or welts on the skin.

## Tell your doctor about the following:

- If you are using your fast-acting inhaler more often or using more doses than you normally do (e.g., 4 or more inhalations of your fast-acting inhaler for 2 or more days in a row or a whole canister of your fast-acting inhaler in 8 weeks' time), it could be a sign that your asthma is getting worse. If this occurs, tell your doctor immediately.
- If you have been using your fast-acting inhaler regularly (e.g., four times a day). Your doctor may tell you to stop the regular use of these medications.
- If your peak flow meter results decrease. Your doctor will tell you the numbers that are right for you.
- If you have asthma and your symptoms do not improve after using ADVAIR regularly for 1 week.
- If you have been on an oral steroid, like prednisone, and are now using ADVAIR. You should be very careful as you may be less able to heal after surgery, infection, or serious injury. It takes a number of months for the body to recover its ability to make its own steroid hormones after use of oral steroids. Switching from an oral steroid may also unmask a condition previously suppressed by the oral steroid such as allergies, conjunctivitis, eczema, arthritis, and eosinophilic conditions. Symptoms of an eosinophilic condition can include rash, worsening breathing problems, heart complications, and/or feeling of "pins and needles" or numbness in the arms and legs. Talk to your doctor immediately if you experience any of these symptoms.
- Sometimes patients experience unexpected bronchospasm right after taking ADVAIR. This condition can be life threatening and if it occurs, you should immediately stop using ADVAIR and seek immediate medical attention.
- If you have any type of heart disease such as coronary artery disease, irregular heart beat or high blood pressure, ADVAIR should be used with caution. Be sure to talk with your doctor about your condition because salmeterol, one of the components of ADVAIR, may affect the heart by increasing heart rate and blood pressure. It may cause symptoms such as heart fluttering, chest pain, rapid heart rate, tremor, or nervousness.
- If you have seizures, overactive thyroid gland, liver problems, or are sensitive to certain medications for breathing.
- If your breathing problems get worse over time or if your fast-acting inhaler does not work as well for you while using ADVAIR. If your breathing problems worsen quickly, get emergency medical care.
- If you have been exposed to or currently have chickenpox or measles or if you have an immune system problem. Patients using medications that weaken the immune system are more likely to get infections than healthy individuals. ADVAIR contains a corticosteroid (fluticasone propionate) which may weaken the immune system. Infections like chickenpox and measles, for example, can be very serious or even fatal in susceptible patients using corticosteroids.

## How should I take ADVAIR DISKUS?

ADVAIR should be used 1 inhalation, twice a day (morning and evening). ADVAIR should never be taken more than 1 inhalation twice a day. The full benefit of taking ADVAIR may take 1 week or longer.

If you miss a dose of ADVAIR, just skip that dose. Take your next dose at your usual time. Do not take two doses at one time.

Do not stop using ADVAIR unless told to do so by your doctor because your symptoms might get worse.

Do not change or stop any of your medicines used to control or treat your breathing problems. Your doctor will adjust your medicines as needed.

## When using ADVAIR, remember:

- Never breathe into or take the DISKUS<sup>®</sup> apart.
- Always use the DISKUS in a level position.
- After each inhalation, rinse your mouth with water without swallowing.
- Never wash any part of the DISKUS. Always keep it in a dry place.
- Never take an extra dose, even if you feel you did not receive a dose.
- Discard 1 month after removal from the foil pouch.
- Do not use ADVAIR with a spacer device.

Children should use ADVAIR with an adult's help as instructed by the child's doctor.

## Can I take ADVAIR DISKUS with other medications?

Tell your doctor about all the medications you take, including prescription and nonprescription medications, vitamins, and herbal supplements.

If you are taking ADVAIR DISKUS, do not use other long-acting beta<sub>2</sub>-agonist-containing medications, such as SEREVENT<sup>®</sup> DISKUS or Foradil<sup>®</sup> Aerolizer<sup>®</sup>, or any reason.

If you take ritonavir (an HIV medication), tell your doctor. Ritonavir may interact with ADVAIR and could cause serious side effects. The anti-HIV medicines Norvir<sup>®</sup> Soft Gelatin Capsules, Norvir Oral Solution, and Kaletra<sup>®</sup> contain ritonavir.

No formal drug interaction studies have been performed with ADVAIR.

In clinical studies, there were no differences in effects on the heart when ADVAIR was taken with varying amounts of albuterol. The effect of using ADVAIR in patients with asthma while taking more than 9 puffs a day of albuterol has not been studied.

ADVAIR should be used with extreme caution during and up to 2 weeks after treatment with monoamine oxidase (MAO) inhibitors or tricyclic antidepressants since these medications can cause ADVAIR to have an even greater effect on the circulatory system.

ADVAIR should be used with caution in people who are taking ketoconazole (an antifungus medication) or other drugs broken down by the body in a similar way. These medications can cause ADVAIR to have greater steroid side effects.

Generally, people with asthma should not take beta-blockers because they counteract the effects of beta<sub>2</sub>-agonists and may also cause severe bronchospasm. However, in some cases, for instance, following a heart attack, selective beta-blockers may still be used if there is no acceptable alternative.

The ECG changes and/or low blood potassium that may occur with some diuretics may be made worse by ADVAIR, especially at higher-than-recommended doses. Caution should be used when these drugs are used together.

In clinical studies, there was no difference in side effects when ADVAIR was taken with methylxanthines (e.g., theophylline) or with FLONASE<sup>®</sup> (fluticasone propionate).

## What are other important safety considerations with ADVAIR DISKUS?

**Pneumonia:** Lower respiratory tract infections, including pneumonia, have been reported with the use of inhaled corticosteroids, including ADVAIR. There was a higher incidence of pneumonia reported in patients with COPD taking ADVAIR DISKUS in clinical studies.

**Osteoporosis:** Long-term use of inhaled corticosteroids may result in bone loss (osteoporosis). Patients who are at risk for increased bone loss (tobacco use, advanced age, inactive lifestyle, poor nutrition, family history of osteoporosis, or long-term use of drugs such as corticosteroids) may have a greater risk with ADVAIR. If you have risk factors for bone loss, you should talk to your doctor about ways to reduce your risk and whether you should have your bone density evaluated.

**Glaucoma and cataracts:** Glaucoma, increased pressure in the eyes, and cataracts have been reported with the use of inhaled steroids, including fluticasone propionate, a medicine contained in ADVAIR. Regular eye examinations should be considered if you are taking ADVAIR.

**Blood sugar:** Salmeterol may affect blood sugar and/or cause low blood potassium in some patients, which could lead to a side effect like an irregular heart rate. Significant changes in blood sugar and blood potassium were seen infrequently in clinical studies with ADVAIR.

**Growth:** Inhaled steroids may cause a reduction in growth velocity in children and adolescents.

**Steroids:** Taking steroids can affect your body's ability to make its own steroid hormones, which are needed during infections and times of severe stress to your body, such as an operation. These effects can sometimes be seen with inhaled steroids (but it is more common with oral steroids), especially when taken at higher-than-recommended doses over a long period of time. In some cases, these effects may be severe. Inhaled steroids often help control symptoms with less side effects than oral steroids.

**Yeast infections:** Patients taking ADVAIR may develop yeast infections of the mouth and/or throat ("thrush") that should be treated by their doctor.

**Tuberculosis or other untreated infections:** ADVAIR should be used with caution, if at all, in patients with tuberculosis, herpes infections of the eye, or other untreated infections.

## What are the other possible side effects of ADVAIR DISKUS?

ADVAIR may produce side effects in some patients. In clinical studies, the most common side effects with ADVAIR included:

- |                                |                       |                                    |
|--------------------------------|-----------------------|------------------------------------|
| • Respiratory infections       | • Bronchitis          | • Musculoskeletal pain             |
| • Throat irritation            | • Cough               | • Dizziness                        |
| • Hoarseness                   | • Headaches           | • Fever                            |
| • Sinus infection              | • Nausea and vomiting | • Ear, nose, and throat infections |
| • Yeast infection of the mouth | • Diarrhea            | • Nosebleed                        |

Tell your doctor about any side effect that bothers you or that does not go away. These are not all the side effects with ADVAIR. Ask your doctor or pharmacist for more information.

## What if I am pregnant, planning to become pregnant, or nursing?

Talk to your doctor about the benefits and risks of using ADVAIR during pregnancy, labor, or if you are nursing. There have been no studies of ADVAIR used during pregnancy, labor, or in nursing women. Salmeterol is known to interfere with labor contractions. It is not known whether ADVAIR is excreted in breast milk, but other corticosteroids have been detected in human breast milk. Fluticasone propionate, like other corticosteroids, has been associated with birth defects in animals (e.g., cleft palate and fetal death). Salmeterol showed no effect on fertility in rats at 180 times the maximum recommended daily dose.

## What other important tests were conducted with ADVAIR?

There is no evidence of enhanced toxicity with ADVAIR compared with the components administered separately. In animal studies with doses much higher than those used in humans, salmeterol was associated with uterine tumors. Your healthcare professional can tell you more about how drugs are tested on animals and what the results of these tests may mean to your safety.

## For more information on ADVAIR DISKUS

This page is only a brief summary of important information about ADVAIR DISKUS. For more information, talk to your doctor. You can also visit [www.ADVAIR.com](http://www.ADVAIR.com) or call 1-888-825-5249. Patients receiving ADVAIR DISKUS should read the medication guide provided by the pharmacist with the prescription.

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**BOULDER, Colorado** The U.S. government has engineered the most ingenious, most accurate clock in the world: the F-1 U.S. Atomic Clock in Boulder, Colorado. Our extraordinary new Stauer Titanium Atomic Watch utilizes the transmissions directly from that remarkable cesium fission atomic clock to report the most precise time. This scientifically advanced timepiece will gain or lose only one second over a 20 million-year period. It is that accurate! This perfectly tuned technological invention with the super light strength of titanium is now available for UNDER \$200.

**Super Light Titanium has two big advantages over steel.** One is corrosion resistance and the other is that titanium has the highest strength-to-weight ratio of any metal, which means that titanium is approximately 45% lighter than steel. But every

other titanium watch that we can find is priced at over \$400, and none of those are nearly as accurate as our atomic movement. Stauer has decided to bring these resources together in a timepiece that has the most accurate movement available today. You'll never have to set this watch. Just push one of the buttons and you are synchronized with the atomic clock in Colorado, and the hands of the watch move to the exact time position. The sleek black textured dial has luminous hands and markers plus the timepiece is water resistant to 3 ATM.

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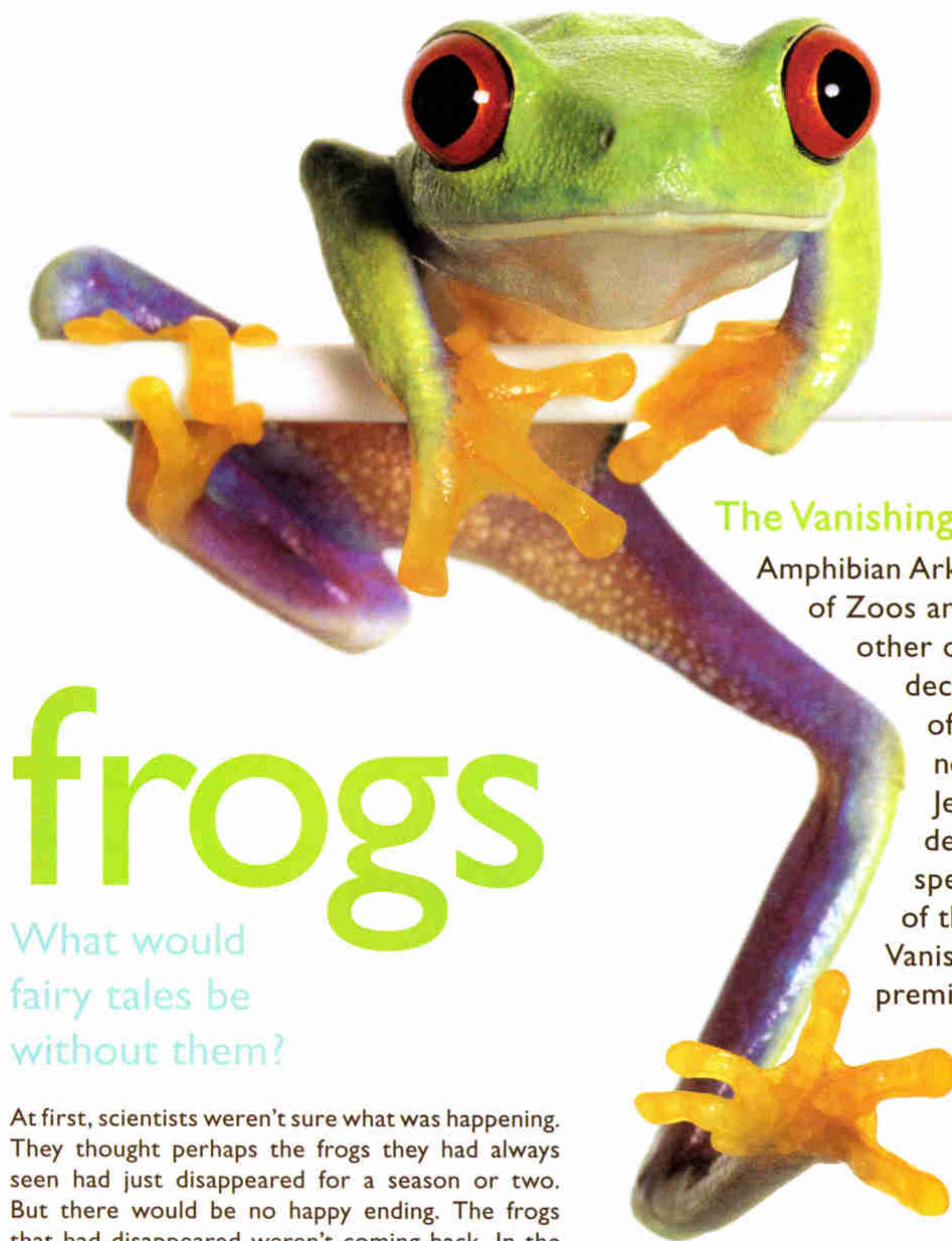




The algae within this five-millimeter jellyfish from the Florida Keys can turn blue light into a red aura.

**Glow Getters** As researchers hunt for better ways to tag and light up certain proteins and cells, they're taking a lesson from glowing sea creatures. Not bioluminescent animals that shine in utter darkness, but fluorescent organisms whose proteins absorb high-energy light like blue or violet and reemit lower energy red, yellow, or green. To study such creatures, marine biologist Steven Haddock of the Monterey Bay Aquarium Research Institute shines a blue spotlight into the depths and watches a green-red video screen to see what glows back. If scientists can customize fluorescing proteins to latch on to, say, cancer cells, surgeons may someday be able to use a similar blue light to search for cancer in humans. —Larry O'Hanlon





# frogs

What would  
fairy tales be  
without them?

At first, scientists weren't sure what was happening. They thought perhaps the frogs they had always seen had just disappeared for a season or two. But there would be no happy ending. The frogs that had disappeared weren't coming back. In the past 20 years, more than 100 species of amphibians have become extinct. As many as half of the world's 6,000 amphibian species are threatened, a large number by a fungal disease called chytrid (KIT-rid).

In the balance of nature, frogs play a starring role. They eat insects that carry disease and help protect the fragile ecosystems of the places they call home. Right now, the only hope of saving frogs is to rescue them — to capture them in the wild and take them into protective custody. It's a pioneering undertaking by Amphibian Ark, a coalition of conservation groups.

## The Vanishing Frog

Amphibian Ark, the Association of Zoos and Aquariums and other organizations have declared 2008 Year of the Frog, and now Animal Planet's Jeff Corwin will devote an entire special to the plight of the frog. "The Vanishing Frog" will premiere this fall on Animal Planet.

**ANIMAL  
PLANET**



The makers of Clorox® products are proud to be the first official corporate sponsor of 2008 Year of the Frog. For more on how Clorox is helping, go to [www.savethefrog.com](http://www.savethefrog.com).



# Green within reach



## New Green Works™ cleaners from Clorox — the natural choice

For years, green and easy just didn't go together. If it was green, it often meant paying a whole lot more for a lot less — less function, less form (hemp shirts, anyone?), just plain less. Setting out to find a natural product really would take an entire village — and a compass. When it came to green cleaners, they either weren't very green or very effective cleaners, or both. It's easy to see why consumers tended to give up.

Finally, big companies are getting the message. With its new plant-based Green Works™ line of products, Clorox has brought cleaning to green: The products are 99 percent natural, work as well as or better than conventional cleaners and the price is right.

Never thought of putting Clorox and green in the same sentence? "As surprising as it sounds, it's a good sign," says Jessica Buttmer, marketing director for Green Works™ products. "If we're serious about living greener, we need big companies like Clorox involved and committed."

After nearly 100 years in business, Clorox certainly knows about cleaning, and with ingredients derived from lemon, corn and coconut, it's a natural.

[www.greenworkscleaners.com](http://www.greenworkscleaners.com)



The maker of Green Works™ natural cleaners is a proud supporter of the Sierra Club's efforts to preserve and protect the planet.



Just what the world needs,  
another cleaning product.

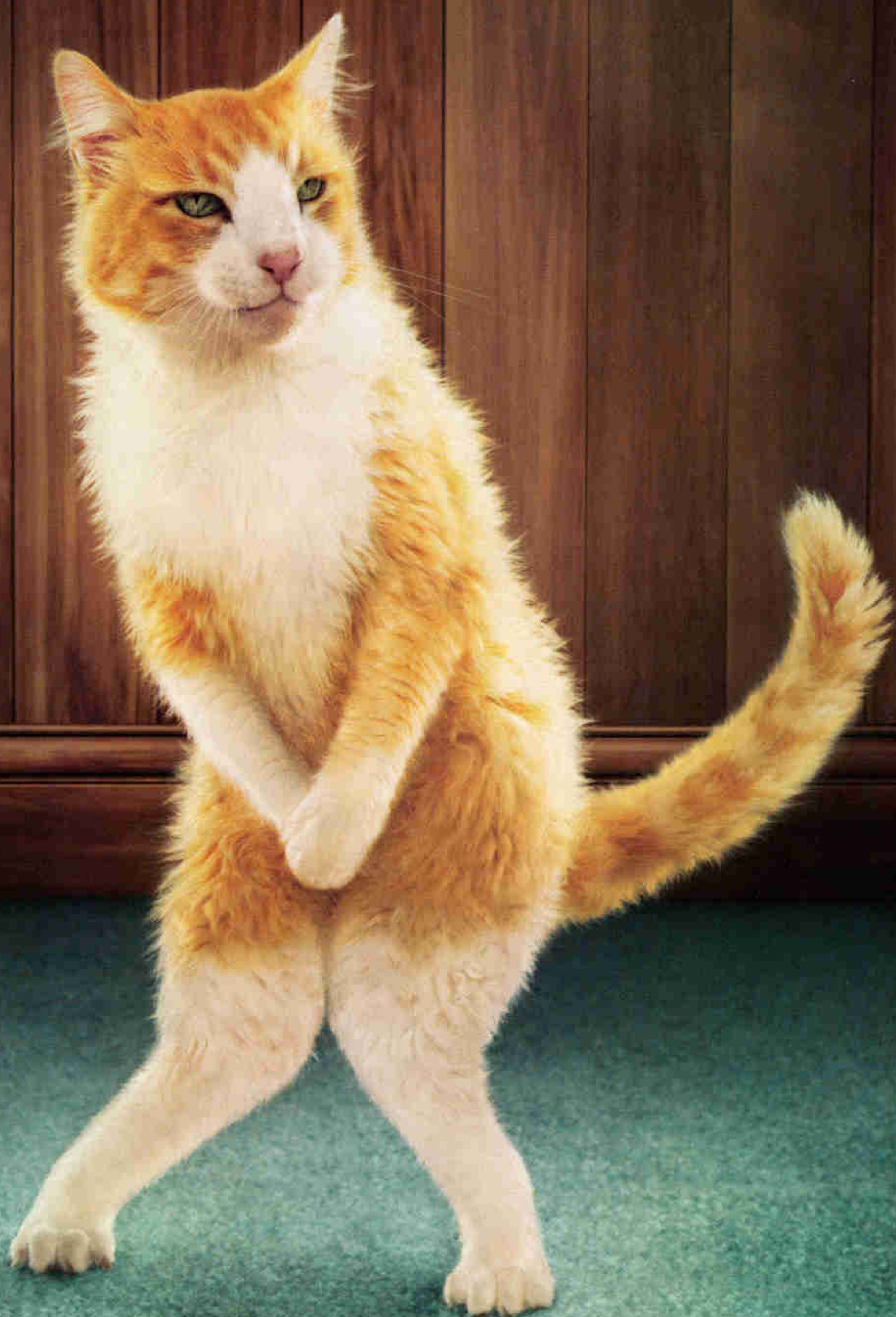
It's made from plants, and cleans as well as traditional cleaners.

Green Works™ is exactly what the world needs.

Finally,







It's hard to find your litter box if you can't smell it.



[freshstep.com](http://freshstep.com)





**Very old-style postcard:** image and message on front.



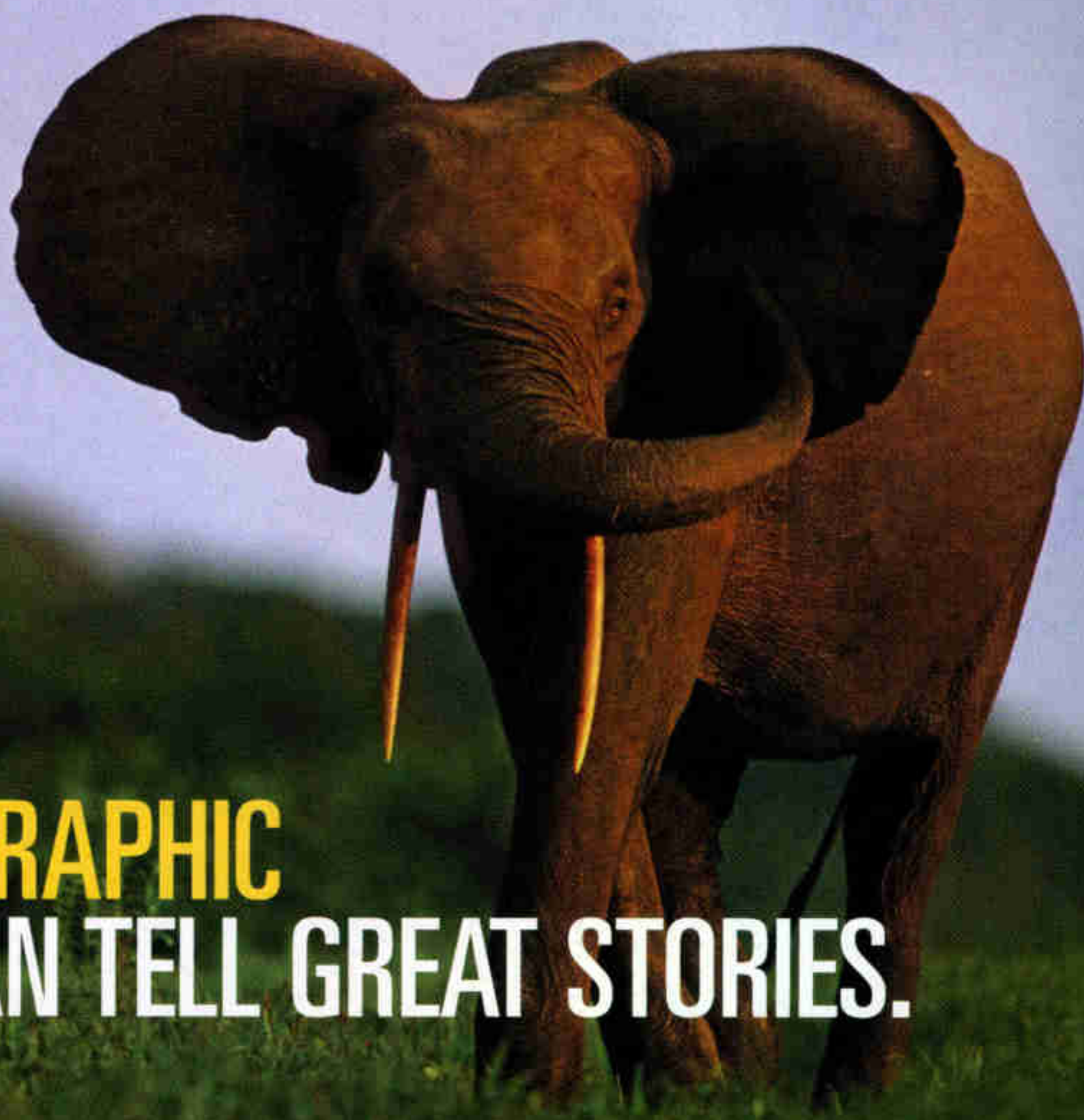
**New in 1907:** printing a little line so notes could go on back.

**Postal Modern** It's such a cliché: "I'll send you a postcard!" But a century ago the cards carried more than just vacation greetings. They were the almost-instant messages of their time. Back then, letter carriers made up to seven deliveries a day in big cities like New York. Correspondents asked about health, made dinner plans, and pursued sweethearts. "Why don't you write?" one young Colorado woman demanded of her beau (who ended up marrying another). On early cards, addresses were on one side, and the missives went on the picture. Then in 1907 the "divided back" debuted in the U.S.: Address and message shared the flip side so images weren't sullied with scrawl. This is the card folks use today, and use it they do. Last year Americans sent over two billion postcards. —Catherine L. Barker





Mission Programs



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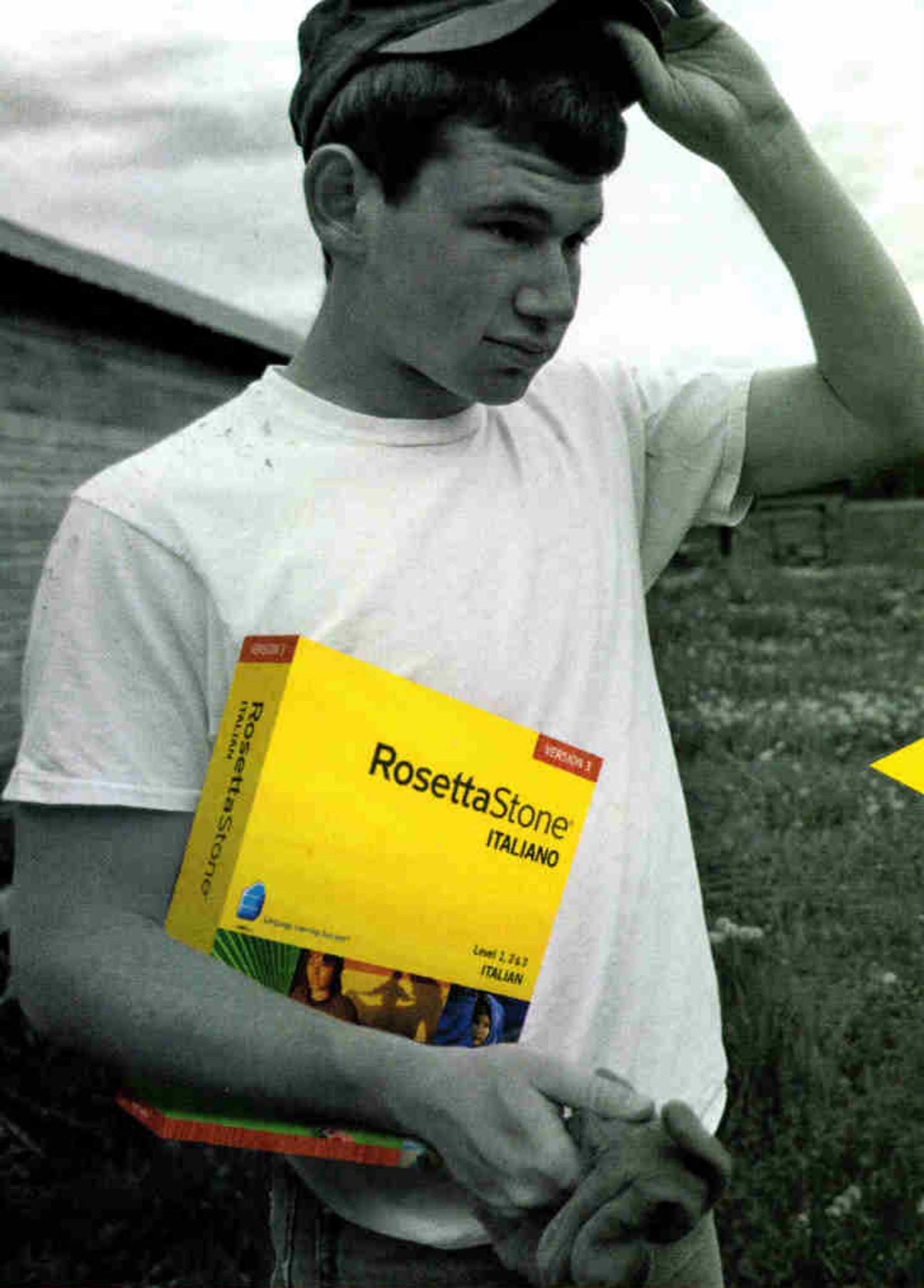
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# If the Stones Could Speak

SEARCHING FOR THE  
MEANING OF STONEHENGE

BY CAROLINE ALEXANDER NATIONAL GEOGRAPHIC CONTRIBUTING WRITER

PHOTOGRAPHS BY KEN GEIGER NATIONAL GEOGRAPHIC STAFF

Long studied yet enigmatic still, the monument looms over England's Salisbury Plain.







The first glimpse often comes from the road. Blurring past on the A303 thoroughfare that cuts heedlessly almost across the monument's very entrance, Stonehenge appears as a cluster of insignificant protrusions on the big, otherwise featureless plain; and yet, even from this profane and glancing vantage, the great-shouldered silhouette is so unmistakably prehistoric that the effect is momentarily of a time warp cracking onto a lost world.

Up close, amid the confusion of broken and standing stones, it still seems smaller than its reputation, notwithstanding the obvious feat represented by the erection of the famous sarsen stones; the largest weighs as much as 50 tons. Unique today, Stonehenge was probably also unique in its own time, some 4,500 years ago—a stone monument modeled on timber precedents. Indeed, its massive lintels are bound to their uprights by mortise-and-tenon joints taken straight from carpentry, an eloquent indication of just how radically new this hybrid monument must have been. It is this newness, this assured awareness that nothing like it had existed before, this revelatory quality, that is still palpable in its ruined stones. The people who built Stonehenge had discovered something hitherto unknown, hit upon some truth, turned a corner—there is no doubt that the purposefully placed stones are fraught with meaning.

But what in fact do they mean? Despite countless theories offered over centuries, no one knows. Stonehenge is the most famous relic of prehistory in Europe and one of the best known, most contemplated monuments in the world—and we have no clear idea what the people who built it actually used it for.

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Caroline Alexander's most recent book, *The Bounty: The True Story of the Mutiny on the Bounty*, was a New York Times best seller in 2003.



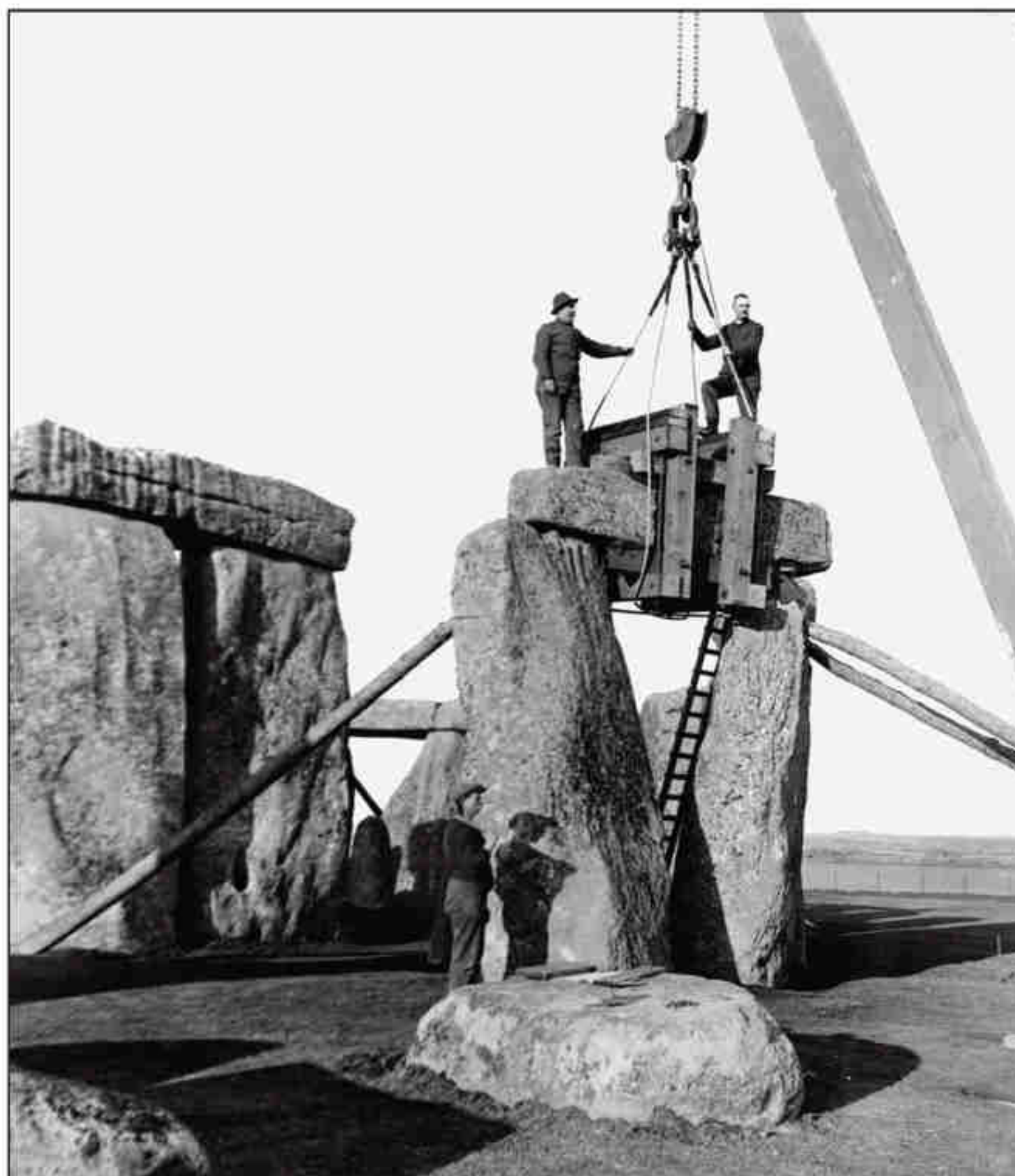
In the past, archaeologists sought to crack this enigma by wringing every fact they could from the stones themselves, subjecting their contours, marks, and even shadows to scrutiny. Recently, though, the search has led investigators farther afield, away from Stonehenge itself to the remains of a nearby Neolithic village on the one hand,

and on the other to a craggy mountain peak in southwestern Wales. While no definitive answer has yet emerged, these two very different searches-in-progress have stirred tantalizing new possibilities.

STONEHENGE AROSE from a rich tradition of equally enigmatic structures. Henges—circular banks of earth paralleled by an internal ditch—earth barrows and mounds, circular timber structures, monoliths, and circles and horseshoes of stone were all common throughout Neolithic Britain and parts of continental Europe. (Strictly speaking, Stonehenge is not, as its name implies, a henge, because the position of its bank and ditch are reversed.) At different stages of its evolution Stonehenge reflected many of these traditions. The first certain structural stones of Stonehenge, the bluestones, which were floated, dragged, and hauled from Wales, most likely arrived sometime before 2500 B.C. The giant sarsens followed, filling out the monument, which was at some point linked by an avenue to the River Avon. Stonehenge, then, is the culmination of



Ancient uprights weighing 35 tons splay dangerously outward as workers avert a collapse in 1919. Long privately owned and deteriorating, Stonehenge had been given to the nation in 1918.



a dynamic evolution; the pre-stone earthworks thrown up in grassland probably embodied different beliefs than the later monument of stone that was resolutely connected to water.

Standing within the collapsed circles, it is not easy to make out the monument's original blueprint. Easier to imagine are the actions that lie behind it: the planning and engineering; the diplomacy required to negotiate transportation of stones through different territories; the logistical maneuvering to supply and equip a labor force; the ability to cajole, inspire, or compel able-bodied men to leave their animals, fields, and hunting grounds—in short, the many necessary human acts that we still recognize, although we know little about who these early Britons were, how they were organized, or what language they spoke.

We do know that some were farmers and pastoralists, and that they had long since begun the task of domesticating their landscape, making inroads into the ancient birch, pine, and hazel

forests. Skeletal remains indicate that despite physically demanding lives, the people of Neolithic Britain were more lightly built than us. Their relative lack of dental decay suggests a diet low in carbohydrates, and although life expectancies are difficult to calculate, people seem, overall, to have enjoyed good health. Then as now, life held unexpected hazards. “Five to 6 percent of these populations showed massive blunt-force trauma to the crania,” according to Michael Wysocki, a senior lecturer in forensic and investigative science at the University of Central Lancashire. “This was equally the case between male and female.” Explanations for this trauma range from ritualized violence to the possibility that life of the era was simply brutal.

Recently, dramatic and wholly chance discoveries have provided biographical outlines of individual men. In 2002 archaeologists working on Boscombe Down, on the east side of the Avon, two and a half miles southeast of Stonehenge,



unearthed two burials dated at between 2500 and 2300 B.C. They contained the remains of a 35-to-45-year-old man whose leg had been badly damaged—he would have walked with a horrific limp—and a younger relative, perhaps his son. The older man's grave contained the richest burial goods of the era found in Britain: gold jewelry for hair, copper knives, flint tools, two archer's wrist guards of polished stone, a "cushion stone" for working metal, along with pottery of the distinctive Beaker style common at the time in continental Europe but not in Britain. Chemical analysis of the tooth enamel of both men gave startling results: The younger man was from the local chalk country of Wessex; the older man, dubbed the "Amesbury Archer," came from the foothills of the Alps in the region of what is now Switzerland and Germany.

"I suppose it was inevitable," said Andrew Fitzpatrick of Wessex Archaeology, who conducted the excavation, with a wan smile, showing me a cartoon depicting Stonehenge flying a German flag. The hard facts suggest a romantic story. Migrating from Europe, with his advanced pottery and his skills in metalworking, the Archer had made good in Wessex, acquiring considerable wealth and status along with a family.

One year after the discovery of the Archer and his companion, and less than a quarter mile away, construction workers laying pipe stumbled on yet another grave from roughly the same period, this one containing the remains of seven individuals, at least four of whom were males, also apparently related and, like the Archer, not native to the area. Analysis of the premolars and molars of the three adults revealed, according to Fitzpatrick, "that they were in one place up to the age of six, and in another up to the age of thirteen." Matches for the place of infancy include northwestern Britain, Wales, or Brittany. "The larger point is not where they came from,"

Fitzpatrick emphasized, "it's that people of the era traveled. This is the best example of prehistoric migration in Europe yet found."

WHILE IT IS NOT FANCIFUL to speculate that these immigrants saw Stonehenge—perhaps even helped build it—remarkable new evidence has recently been unearthed about the community that surely used it. Since 2003 the Stonehenge Riverside Project, headed by Mike Parker Pearson of the University of Sheffield and

five other team leaders and supported by the National Geographic Society, has been conducting a series of excavations of the wider Stonehenge landscape, focusing on a massive henge, some 1,500 feet in diameter, known as Durrington Walls. Nearly two miles northeast of Stonehenge, Durrington was known as early as 1812 and excavated



A finely polished gneiss mace head graced an ancient grave near the stones.

in the 1960s ahead of road construction. Erosion and land use have now blurred its once formidable outlines, made of earth banks formerly as wide as one hundred feet and at least as high as ten.

In and around the giant henge were three circular timber structures whose footprints survive in traces of their postholes. Two—the Northern and Southern Circles—lay within the henge itself, while a later monument known as Woodhenge stood just outside. "There is evidence to suggest that timber circles were secretive places, their interiors hidden by screens as well as the multiplications of posts," said Alex Gibson, an authority on timber circles at the University of Bradford. Recently, inside the henge banks, the Riverside Project unearthed two structures, lofty and distinguished by individual ditches and palisades, perhaps residences of elite officials overseeing the circle, or even cult houses.

Outside the henge and under the embankment, the project excavated a cluster of seven small houses. Tentatively dated at between 2600 and 2500 B.C., they (Continued on page 50)



# STAGES OF STONEHENGE

## EARTHWORK ENCLOSURE

A circular ditch-and-bank monument some 375 feet across was cut into the chalk of Salisbury Plain about 3000 B.C. This earthwork is the "henge" in Stonehenge, though most Neolithic henges were built with the ditch inside the bank. Timber posts may have stood in some of the 56 circular pits that lined the bank's inner edge.

## TIMBER MONUMENTS

A distinct new phase took shape in the middle to late Neolithic period. Timber posts were erected in linear patterns near the northeast entrance and across the center toward the southern entrance. Cremation remains lead archaeologists to believe the site was being used as a cemetery.

## ENTER THE STONES

### Bluestones

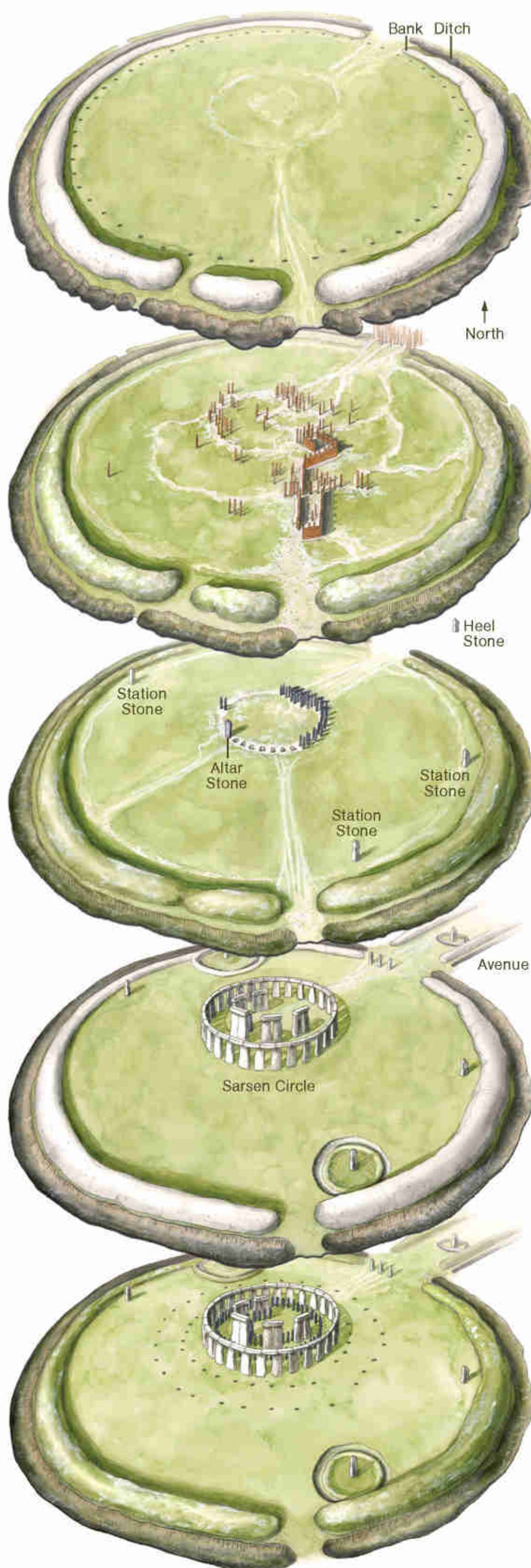
Circular or semicircular arrangements of stones probably appeared by 2500 B.C., the earliest being pairs of four-ton bluestones (their color when wet) now known to have been brought about 250 miles from Wales. Also added: features called Station Stones, the Altar Stone, and the Heel Stone just outside the northeast entrance.

### Sarsen Circle

Stonehenge gained its iconic shape with the creation of the 16-foot-high Sarsen Circle—30 worked stones topped by lintels. In a horseshoe configuration inside the circle towered five freestanding trilithons, each formed of two upright stones linked by a lintel. The tallest reached 25 feet. The chalk bank was recut, small circular earthworks were added, and a banked avenue ran nearly two miles to the River Avon.

### Later Refinements

Bluestones that had been cast aside were repositioned as a circle and a horseshoe within the Sarsen Circle, and a double ring of pits was dug. By about 1500 B.C. Stonehenge was no longer maintained.



ART BY OLIVER UBERTI, NG STAFF. SOURCES: MIKE PARKER PEARSON, UNIVERSITY OF SHEFFIELD; SCIENCE AND STONEHENGE, BARRY CUNLIFFE AND COLIN RENFREW, EDS.





## KINDRED SITES

At twilight on Salisbury Plain in 1500 B.C., a falcon's-eye view takes in a land tattooed with earthworks, most by that time abandoned. Durrington Walls (foreground), a henge nearly two miles northeast of Stonehenge and 20 times larger, once held circular timber monuments, as did adjacent Woodhenge. Cryptic trenches like the Cursus are numerous in Britain. Avenues from Stonehenge and Durrington Walls to the River Avon suggest to some scholars that the sites were ritually linked.

ART BY KAZUHIKO SANO





Their tips blunted as Neolithic laborers used them to gouge through chalky ground, antler picks carved massive earthworks at Stonehenge and Durrington Walls. The picks give archaeologists a means of carbon dating the sites where they're found.







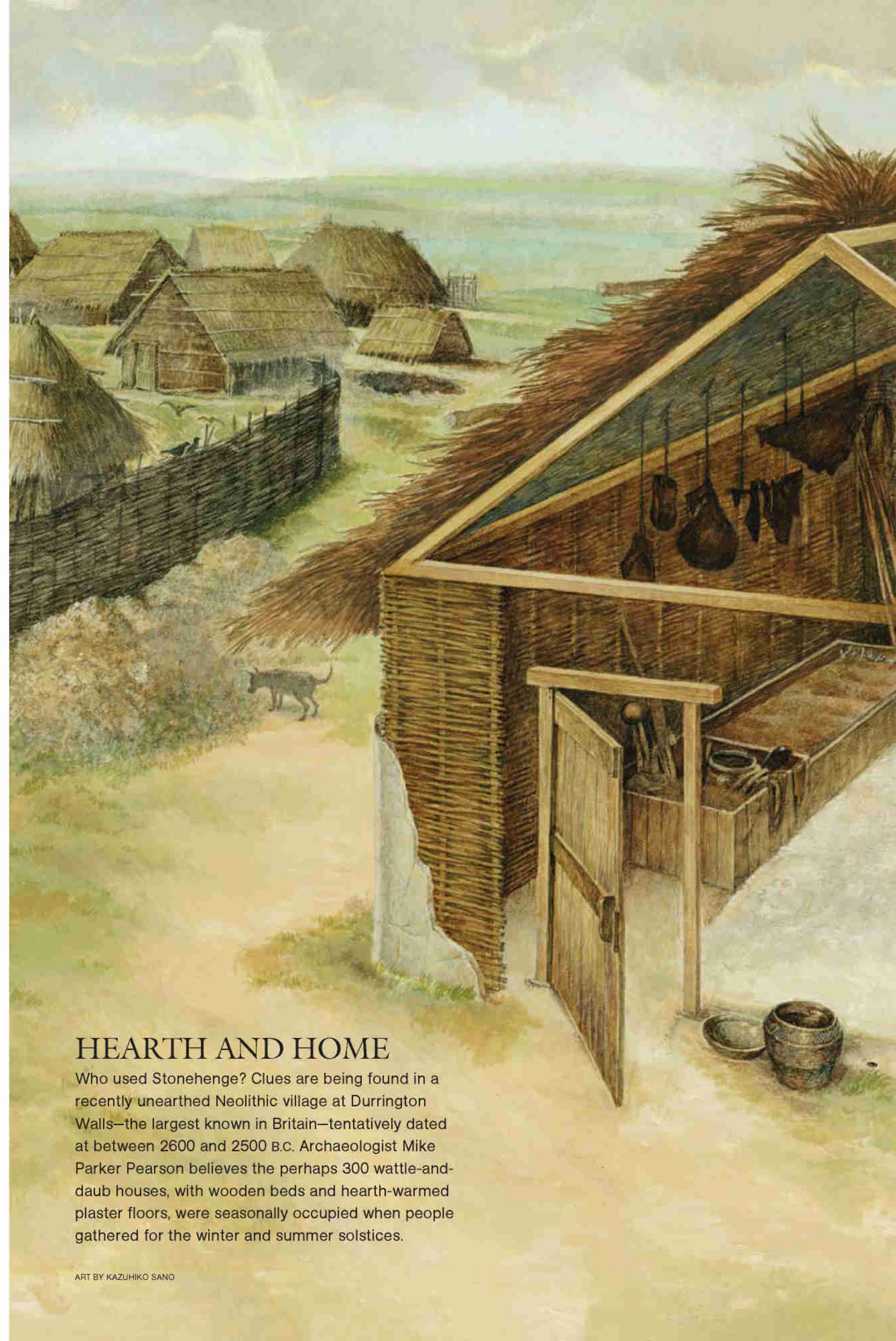
Lights in nearby Amesbury set low-hanging clouds aglow, and the standing stones turn otherworldly beneath a burning sky. But their surfaces bear witness to homely labor: Topping the tallest stone, once part of a trilithon, is a tenon—half of a mortise-and-tenon joint borrowed from woodworking.







The earliest metal knives found in Britain come from the grave of a rich man buried a few miles from Stonehenge around 2400 B.C. Made of soft copper from France and Spain, they were likely duller than the flint knives typical of the age, and may have been used only for ceremony.



## HEARTH AND HOME

Who used Stonehenge? Clues are being found in a recently unearthed Neolithic village at Durrington Walls—the largest known in Britain—tentatively dated at between 2600 and 2500 B.C. Archaeologist Mike Parker Pearson believes the perhaps 300 wattle-and-daub houses, with wooden beds and hearth-warmed plaster floors, were seasonally occupied when people gathered for the winter and summer solstices.

ART BY KAZUHIKO SANO







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(Continued from page 38) straddle a hundred-foot-wide flint-paved avenue to the Avon. Standing inside the foundation outline of one of the houses, Mike Parker Pearson pointed out domestic details, such as an oval hearth in the middle of the floor. “These are heel, or maybe buttock, marks,” he said, squatting by way of demonstration beside indentations on the plaster floor. Remains of a cooking area stood to one side. Five houses show evidence of furniture, including slot marks for the edges of wooden beds. Parker Pearson waved a hand toward the dark tree fringe in the distance. Trial excavations and geophysical surveys have detected a multitude of other possible hearths in the valley. “There may be as many as 300 houses,” he said, making it the largest Neolithic settlement found in Britain.

Drawing on field experience in Madagascar, Parker Pearson advocates a bold interpretation of the site and, with it, the “answer” to Stonehenge. In Malagasy culture, the ancestors are revered with stone monuments, signifying the hardening of bodies to bone and the enduring commemoration of death; wood, by contrast, which decays, is associated with transient life. Stone is ancestral and male, while wood, as Parker Pearson put it, is “soft and squishy, like women and babies.” As he allows, no such gender distinction has yet been discerned in Britain, but it’s the same principle underlying Western commemorative practice: “You lay flowers on the grave, then you put up a tombstone.”

Guided by this model, Parker Pearson sees suggestive associations between Durrington Walls, with its defining wooden structures, and the hard monumentality of Stonehenge. Durrington has a path to the Avon that could be a ceremonial avenue, though it is just over 550 feet long, while that at Stonehenge runs a mile and three-quarters, and its processional character is defined by flanking ditches and banks.

To Parker Pearson, the contrasts are equally suggestive. Stonehenge is aligned on both the

Sifting rubble from the Cursus—a Neolithic earthwork half a mile from Stonehenge—archaeology students look for small artifacts. Last year some 270 people worked on the Stonehenge Riverside Project, a major dig examining multiple sites in Salisbury Plain’s ancient ceremonial landscape. The aim: to discover if the plain’s monuments had interlocking purposes.



axis of the summer solstice sunrise and the winter solstice sunset, while the Southern Circle at Durrington Walls catches the winter solstice sunrise. A profusion of pottery and animal bone debris, especially of pigs, implies that Durrington Walls saw much feasting, while very little pottery has been found at Stonehenge. Scarcely any human remains have been found at Durrington, but 52 cremations and many other burials have been uncovered at Stonehenge, which may contain as many as 240—the largest Neolithic cemetery in England. Durrington, in this new theory, represents the domain of the living, and Stonehenge, the domain of the ancestral dead, with the two linked by seasonal processions along

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a route formed by the avenues and the river. The ashes of most of the dead would have been entrusted to the river. Other cremated remains, possibly the society's elite, were deposited ceremonially at Stonehenge itself.

"Many specialists would go along with the dead and living in a loose sort of way," said Mike Pitts, editor of the journal *British Archaeology* and one of the few people around today who have actually excavated at Stonehenge. It is the details of the new theory that are problematic. The assumption has always been that burial remains at Stonehenge were common only during the period of the pre-stone earthworks and timber structures, though Parker Pearson

now believes they continued into the period of the stones. But environmental evidence from the immediate landscape around Stonehenge indicates the usual activities of the living, such as farming and grazing of animals, which do not seem compatible with a larger ritualized domain of the dead. And there is no agreement about when the sarsen stones arrived. Similarly, the date of the avenue leading from Stonehenge to the Avon, the necessary link between the two sites, needs to be resolved by more evidence. Filling in these gaps is crucial for any meaningful correlation of activities between the two sites.

Summing up, Pitts said of Parker Pearson's theory: "The value of this interpretation is not







## DISTANT TRAVELER

The man was footloose and fabulously rich. Isotopic tooth analysis shows that the "Amesbury Archer," unearthed in 2002, grew up in the Alps. He was buried around 2400 B.C. with metalworking tools, a quiver of fine arrows, and the earliest gold yet found in Britain—hair ornaments (lower left). What brought him to within a few miles of Stonehenge at its height? Another mystery.




just the idea of linking stones and ancestors, but that it works with the entire landscape. Previous interpretations have taken the independent sites separately."

IRONICALLY, A MORE DIRECT approach to the heart of Stonehenge might lie in fieldwork far from its own landscape, miles away in a small site amid convulsed, fractured outcrops of dolerite and shale in the Preseli Mountains of southwestern Wales—the source of Stonehenge's oldest stones, the fabled bluestones. The erection of the bluestones marked a critical transition from the original timber settings toward the monument we have today. "Dusted with magic," is how one archaeologist described the famously atmospheric hills to me, in a region long known for its intriguing stone circles, dolmens, and other megalithic monuments. As long ago as 1923, specific outcrops around Carn Menyn, at the eastern end of the Preseli hills, had been identified as the bluestone source; subsequent geochemical work in 1991 refined this to roughly one square mile.

Yet for more than 80 years after the discovery of the bluestone source, "no one actually got their trowel out and did anything," said Timothy Darvill, a professor of archaeology at Bournemouth University. "It's perverse, really." Together with Geoffrey Wainwright, a distinguished authority on the Neolithic and the original excavator of Durrington Walls in the 1960s, Darvill began a systematic survey around Carn Menyn in 2001, accompanied by a small team of researchers from Bournemouth University, including Yvette Staelens, a senior lecturer. "It's a place where strange things happen," Staelens said of the hills. She described reaching the top of a sheer rock outcrop and finding a fox impaled on rock. "Guts and blood were spilling down—we think a large raptor must have dropped it. Strange things like that."

"It's a natural monument," said Wainwright, of the chaotic rock formations of columns and pillars that litter the ground. "The stones of Stonehenge didn't have to be quarried; they could be simply carried off." Up to six feet in





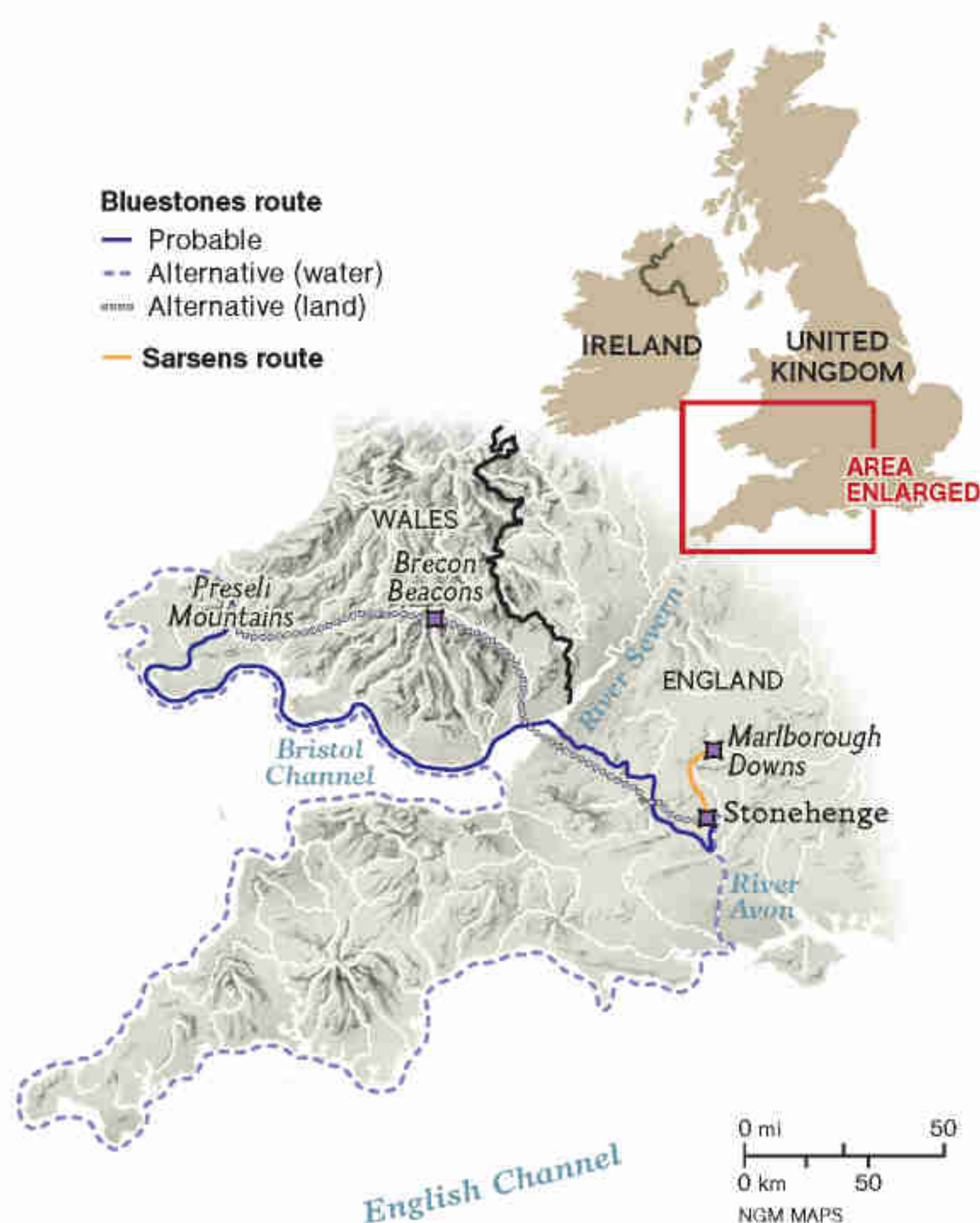
Nature alone set up these standing stones in Wales's Preseli Mountains, source of the first stones installed at Stonehenge—the bluestones. Local folklore attributes healing power to springs gushing from the hills, and some researchers speculate that's why the stones were moved 250 miles east. Stonehenge may have been a place of healing.

ANDREW HENDERSON

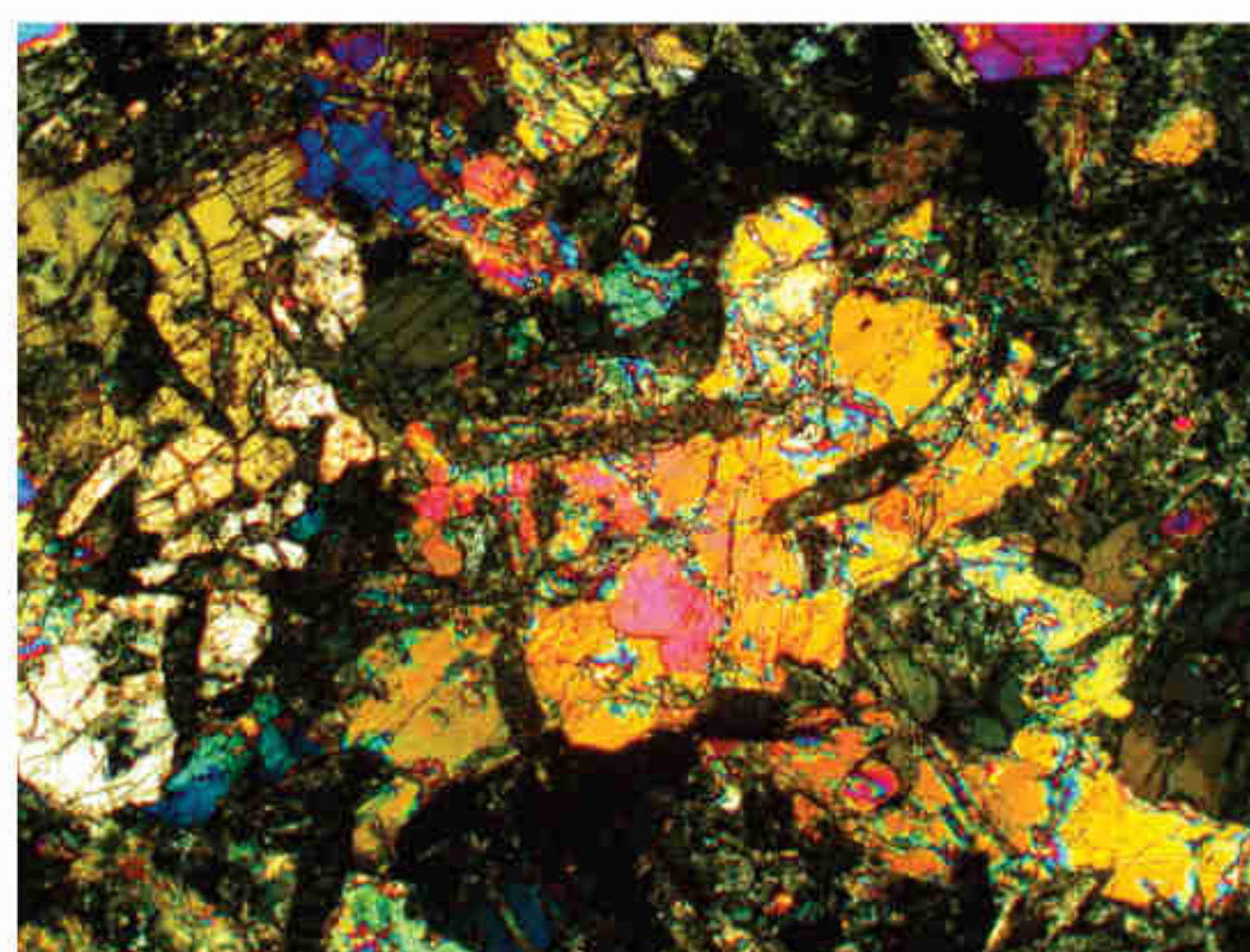








Microscopic analysis (below) of Stonehenge's bluestones confirms their Welsh origin in hilly terrain. Their quarrying and transport along a land and water route of 250 miles (map, left) required coordination among several populations. But more than a thousand years earlier, people in the Preseli Mountains were already moving stones, building tombs like one at Pentre Ifan (right), foreshadowing what was to come.



height and four tons, the approximately 80 original bluestones—the exact number formerly located at Stonehenge is unclear—are mostly dolerite spotted with milky feldspar. Freshly cut and wet with rain, they do indeed glisten blue. Still, these are not the only striking stones within the British Isles. “Why did they bring these stones 250 miles to build Stonehenge?” Wainwright asked. “And why did they retain these stones throughout its structural history?”

So far the Preseli hills have not yielded an answer, but they do offer some clues. As Staelens recalled, on the first day Wainwright and Darvill began their field survey, Wainwright laid his hand on a rock. “And it had rock art. The pair of them were very academic blokey about the discovery. Geoff said, ‘Look at this, Tim.’ Tim said, ‘That looks important, Geoff.’ They just stood there, very British low-key.”

The handful of examples they eventually discovered of the distinctive “cup mark” art, a motif of circular hollows within hollows, could

be dated only very broadly at between 3800 and 2000 B.C. “We didn’t get anything we could confidently put in for dating,” Darvill said. This much, however, is known: Perhaps as early as 4000 B.C., people were constructing monuments in this atmospheric area where rock pinnacles seem to pierce the sky and commemorating the site with motifs associated elsewhere with “special” sites. “In Neolithic times people are going to the Preseli hills and venerating them,” was how one archaeologist put it.

Whether the stones were moved to Salisbury Plain in a single, sustained campaign or an ongoing effort spread out over a generation or more is not known. Similarly, how the stones were transported has been hotly debated over the years. “That’s a blue-collar question,” Wainwright said, relishing what was clearly a well-rehearsed line, “and I am not an engineer.” Although glacial drift may initially have worked the stones loose from the hills, an old theory that glaciers swept them onto Salisbury Plain has been





discounted by modern studies; somehow people must have moved them. The shortest accepted route—by river and along the coast of Wales, across the Severn estuary, into the upper reaches of the Avon—is about 250 miles. It is impossible to judge just how remarkable a feat such transport was in its day. As Darvill points out, in continental Europe even more massive stones were being lugged around. “Increasingly, the ‘unaccountable effort’ argument is under attack,” Darvill said. “The Grand Menhir in Brittany—what does it weigh? Three hundred and forty tons, something like that, and it was moved at least a few miles.” Whether the stones were pulled by teams of men or oxen, on sleds with greased tracks, giant rollers of wood, or some other unsuspected means, Neolithic man evidently, as Darvill said, “had transportation sorted out.”

Archaeologists can only speculate about the significance of the bluestones. Carn Menyn may have been a landmark charged with special meaning in a key overland route for trade or

travel. Some claim the arrangement of the types of bluestone—dolerite, rhyolite, and tuff—at Stonehenge mirrors their natural arrangement on Carn Menyn. Then again, perhaps the very effort of transporting the stones or their exotic nature was the point—a kind of statement of ability and power.

Darvill and Wainwright believe the answer lies in an old tradition. Writing in the 12th century A.D., Geoffrey of Monmouth, in his rambling, gossipy meander through the history of the kings of Britain, gave a fanciful account of how Stonehenge was carried bodily—on the orders of the wizard Merlin, no less—from Ireland to Salisbury Plain, where it was set down to be a place of healing. The story may represent oddments of tenaciously preserved folk memory garbled by a long—in this case, 3,600-year-old—oral tradition; the stones of Stonehenge were, after all, brought from a far place in the west by seemingly magical means.

Rounding out this story is an old local belief,



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still potent today, that attributes healing powers to springs arising in the Preseli hills. The sum of these two traditions posits Stonehenge as a kind of Lourdes of the prehistoric world. “I mean, it’s plausible,” as one expert said of this healing theory. Others are more skeptical: “Embarrassingly odd,” was a dismissive phrase I heard. Until further evidence comes to light, then, the trail returns to where it began, with only the most basic of hard facts: People had found something special in the Preseli hills and transported this to southern England.

AT THE TIME the bluestones arrived on what is now Salisbury Plain, the old-growth forest had been cleared for centuries into open grassland. If brought by river, the stones would have been dragged from the willow-and-sedge-lined banks of the Avon up to the site. Decoratively stippled, grooved and smoothed, the stones were erected in pairs to form a double arc and were perhaps also yoked by lintels that have since fallen away.

The old earthworks were now refashioned to highlight the northeast entrance, thus confirming the import of the monument’s alignment with the solstices—an emphasis that perhaps reflected beliefs about the meaning of the stones in their location at Preseli, or perhaps the new beliefs of a changing age. At some later date the giant sarsens of hard sandstone were dragged in from the Marlborough Downs, 20 to 30 miles away. Although subsequent ages would fiddle with the internal design, the erection of the sarsens—the great broad-shouldered guardians of the smaller stones from Wales—bestowed on Stonehenge its enduring aura of unassailable assurance. Mystifying as it is to us, there is no mistaking the confident purposefulness of its massive, monumental features.

Studies conducted by Michael Allen, an expert in environmental archaeology, demonstrate that throughout the long period of Stonehenge’s construction, people of the area carried on with the mundane tasks of their lives. Charcoal remains, pollens of weeds associated with crops, and, most valuably, snail shells—which can be matched to

different habitats—show that the Stonehenge landscape was cleared, grazed, and farmed. Whatever its function, Stonehenge was embedded in the community it served. “I see it being used like a cathedral, or Wembley Stadium,” Allen said. “Some days it was used to hold solemn rituals, other days for more ordinary gatherings.”

That so much has been found so recently on this historic landscape underscores how much may yet be revealed. Archaeologists hope to excavate at Stonehenge for the first time in a quarter century, searching for remains that would correct the site’s notoriously unsatisfactory dating. Projected work on the avenue could reveal when it was extended to the Avon, clarifying at what stage the river became ritually linked to the monument. Cremation remains that were excavated and reburied as long ago as 1935 could benefit from rigorous new analysis with up-to-date technology. At the Welsh end of the story, Wainwright and Darvill hope to establish when the bluestones arrived. Fieldwork already under way in the Preseli hills may also yield datable burial finds, possibly shedding light on the significance of the Preseli stones. A reexamination of skeletal remains from the Stonehenge area would indicate whether a high percentage of the people had been in need of “healing.”

TO ALL THOSE who seek to read the meaning of Stonehenge in its stones, ritual texts from the dawn of history offer cautionary tales. Take, for example, a random Late Bronze Age text of ritual practice from the Luwians, who lived in what is now Turkey between roughly 1700 B.C. and 800 B.C.: “Then they hold it [the sheep] out to him and he spits into its mouth twice. The Old Woman speaks as follows, ‘Spit out pain and woe, the god’s anger....’ Then they bring a piglet of dough and a living piglet. They wave the living piglet at some distance.” It is fair to say that no diligent fieldwork or application of logic and reason could have led even a visionary archaeologist to reconstruct this ritual from artifacts like bones and ceramics. There are no texts to explain Stonehenge. Secure in its wordless prehistory, it can thus absorb a multitude of



Weathered and broken, but still guarding secrets after more than 4,500 years, Stonehenge is the heart of an elaborately sculpted landscape. Archaeologists hope to dig for pieces of the ancient puzzle within the circle itself this year—the first such excavation in decades.



“meanings”: temple to the sun—or the moon, for that matter; astronomical calendar; city of the ancestral dead; center of healing; stone representation of the gods; symbol of status and power. The heart of its mystique is, surely, that it excites in equal measure both zealous certitude and utter bafflement.

Stonehenge represented the end of the grand tradition of monument building in Neolithic England. It fell out of use around 1500 B.C., and over the centuries many of its stones toppled, broke, or were carried off—casualties of nature as well as man. From time to time reports were made about the enigmatic ruins. A first-century B.C. Greek historian, Diodorus of Sicily, cites a lost

account set down three centuries earlier, which described “a magnificent precinct sacred to Apollo and a notable spherical temple” on a large island in the far north, opposite what is now France. (Apollo, intriguingly, is the god of healing.)

In more recent history Samuel Pepys, the great diarist, visited the stones in the summer of 1668, hiring horses and a guide to take him over the plain. His account still resonates today. The stones, he wrote, were “as prodigious as any tales I ever heard of them and worth going this journey to see. God knows what their use was.” □

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➤ **Enter the Henge** Explore Stonehenge in a 3-D photographic model at [ngm.com](http://ngm.com).

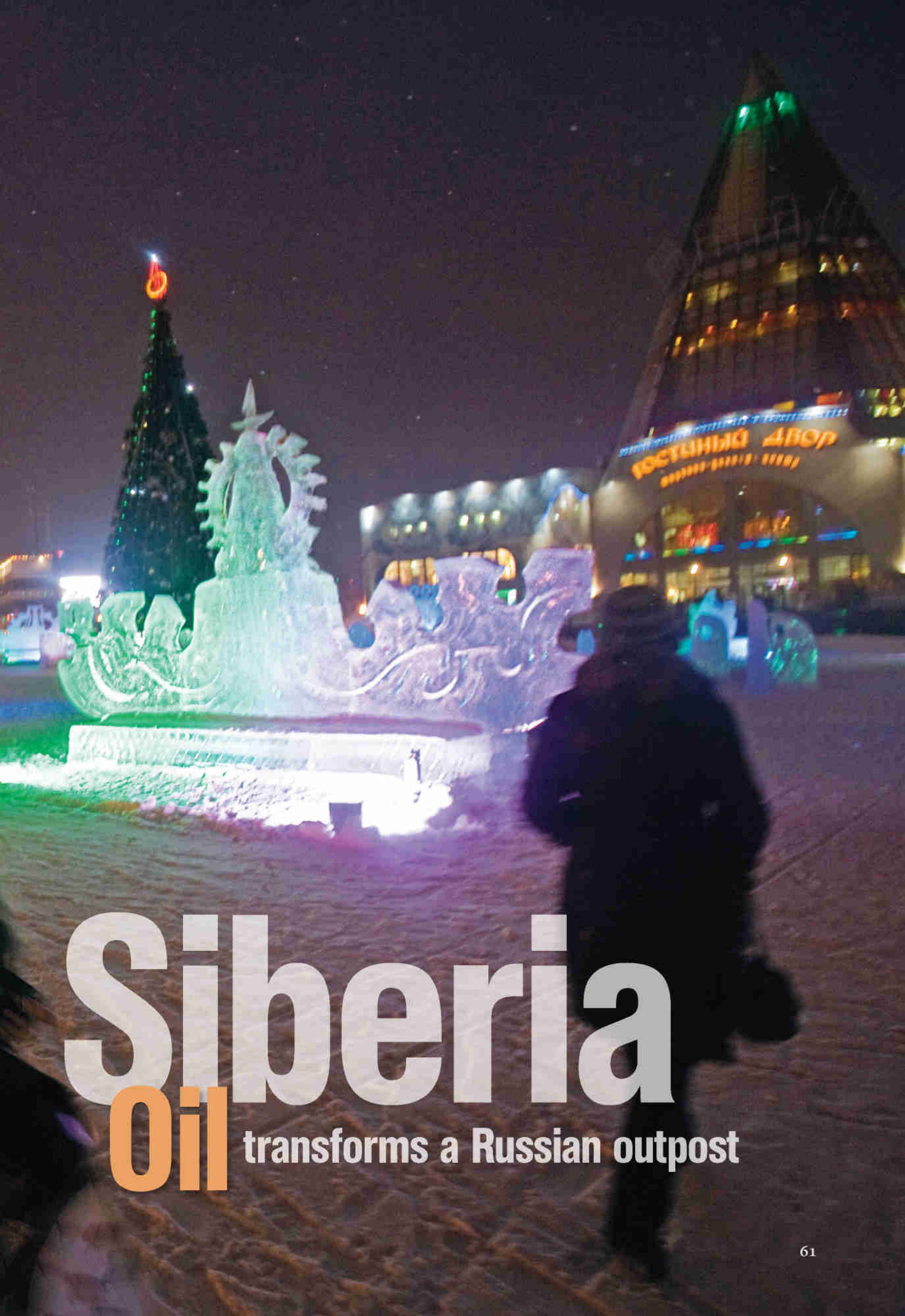


A photograph of two women in winter hats smiling in a snowy night city street. The woman in the foreground wears a white knit hat and a dark coat, while the woman behind her wears a black hat and a dark coat. They are standing in a snowy area with festive lights and trees in the background. The text "send me to" is overlaid in large white letters.

# send me to

Brightening the long Siberian winter, ice sculptures gleam in Khanty-Mansiysk, resurgent capital of Russia's richest oil region.





# Siberia

## Oil transforms a Russian outpost





**NEW PERKS** at the Rodnichok —“little spring”—kindergarten in Surgut include a heated pool. The 30-year-old school, now city owned, has been transformed with funds flowing into public coffers from the region’s thriving energy operations.









**MUD-SPATTERED** and cold, oil workers change a drilling pipe. Russia's oil industry has been expanding for nearly a decade, its growth fueled by surging world oil prices. National production has reached nearly ten million barrels a day.





РЕГУЛЯРНО  
ПРОВЕРЯЙ  
СОСТОЯНИЕ  
ПРОТИВОУДАРНОГО  
ОБОРУДОВАНИЯ

ВНИМАНИЕ  
ПРИ РАБОТЕ  
СЛЕДИТЕ ЗА  
ПОКАЗАНИЯМИ  
ДАТЧИКА

АКБ  
АК





**GAS FLARES** and rig lights sear the night sky in the Savuiskoye oil field. Russia is now the world's top producer of crude oil. Some 70 percent of its reserves are found in western Siberia. Once extracted, most oil is shipped to foreign consumers.







BY PAUL STAROBIN

PHOTOGRAPHS BY GERD LUDWIG

# It's around midnight,

and the couples on the dance floor at the Palace Restaurant are gently swaying to a slow one. "Za nas, za neft—To us, to oil," the singer croons,

*Wherever life sends us,  
To us, to oil...  
We fill our glasses to the brim.*

It is Oilers' Day in the western Siberian province of Khanty-Mansi. This annual holiday, honoring the hard labor of the oil workers, the *neftyaniki*, falls early in September, after the worst of the summer mosquito season and before the first snowfall, in October. Hours earlier, as daylight faded, thousands crowded into a huge outdoor sports complex. A stage was framed by a deep-green backdrop of unbroken forest. Balloons were released, torches were lit, and a troupe belted out a song:

*There is only one joy for us,  
And this is all we need,  
To wash our faces in the new oil,  
Of the drilling rig.*

Little wonder Russians are toasting oil: These are boom times. Global oil prices have increased tenfold since 1998, and Russia has pulled ahead of Saudi Arabia as the world's top crude oil producer. The Kremlin's budget now overflows with funds for new schools, roads, and national defense projects, and Moscow's nouveau riche are plunking down millions of dollars for mansion-scale "dachas."

The pumping heart of the boom is western Siberia's boggy oil fields, which produce around 70 percent of Russia's oil—some seven million barrels a day. For Khanty-Mansi, a territory nearly the size of France, the bonanza provides an unparalleled opportunity to create modern, even desirable living conditions in a region

whose very name evokes a harsh, desolate place. Khanty-Mansi's regional capital, scene of the holiday revelries, is being rebuilt with oil-tax proceeds. The new structures include an airport terminal (once a wooden shack with an outhouse), an art museum featuring paintings by 19th-century Russian masters, and a pair of lavishly equipped boarding schools for children gifted in mathematics and the arts. Even the provincial town of Surgut, a backwater only a few decades ago, is laying out new suburbs and is plagued by traffic jams.

But the opportunity presented by oil could slip through the region's fingers. Despite the remarkable surge in oil prices, oil production in western Siberia has leveled off in recent years. Output barely rose from 2004 to 2007—a period when the rulers of the Kremlin, a cold-eyed and control-oriented crew, seized choice fields once held by private oil barons. The oligarchs, as they were known, were rapacious sorts who jostled among themselves for spoils. But they also heavily invested in the fields in order to maximize production and profits. The Kremlin, by contrast, aims to exploit oil not only as a source of national wealth, but also as a political tool for making Russia a great world power once again. Its heavy-handed tactics have made foreign investors wary and could undermine the boom—and with it Khanty-Mansi's chances for a brighter future.

WESTERN SIBERIA'S great oil deposits lie under lands that an exiled Marxist revolutionary, suffering in the gulag, once called the "waste places of the Earth." But to someone visiting by choice, oil country looks fetchingly wild and pristine. The terrain is dominated by taiga—dense forest of spindly birch, cedar, and pine—and *boloto*,





**GRAY-HAIRED** political veteran Alexander Filipenko (left) works a reception. The longtime governor of Khanty-Mansi has fought to ensure that oil profits benefit his remote region.

peaty marsh that is frozen for most of the year and in spots bubbles with methane. There are no mountains and few hills, but there are numerous lakes, rivers, and streams.

Oil exploration began in earnest here in the mid-1960s. When geologists reported that large reserves of oil were waiting to be tapped, the Kremlin organized a frenzied military-style invasion of “pioneers” and bulldozers to ramp up production. Western Siberia, it turned out, had even more black gold than anyone had dreamed: More than 70 billion barrels have been pumped over the past 40 years.

In the early days “Siberia was all frontier,” says Khanty-Mansi’s governor, Alexander Filipenko. The governor appears older than his 58 years, with a shock of gray hair, watery eyes, and a mottled nose that has weathered its share of frost. Filipenko arrived in Khanty-Mansi in the early 1970s with orders to lay a bridge over the Ob River, which in the late 19th century was a route for squalid barges transporting prisoners to their final places of banishment. The bridge project took four years of toil under

brutal conditions. Yet despite the hardships, the governor looks back at that time the way an old man might recall his first love for a beautiful young woman.

Filipenko is equally passionate about his latest project—the redevelopment of the provincial capital, Khanty-Mansiysk, a town of 60,000. He attends to every detail, and he has the funds to remake the capital to his liking. The province’s oil industry generates 40 billion dollars in annual tax revenues, 4.5 billion dollars of which Khanty-Mansi gets to keep for its own use. The rest goes to Moscow.

His party background notwithstanding, Filipenko’s vision is a distinctly non-Soviet one. The capital’s leading architectural symbols include a shopping emporium topped by an enormous green dome in the shape of a *chum*, the traditional tent used by the region’s

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*Paul Starobin, former Moscow bureau chief for Business Week, is writing a book about life after the American Century. Gerd Ludwig frequently covers Russia for National Geographic.*





**TRADITIONAL LIFE** for indigenous herders requires reindeer and room. Oil rigs and pipelines disrupt the nomads' access to herd migration routes and feeding grounds.

indigenous people—the Khanty, Mansi, and others who herd reindeer, hunt, and fish. That symbolism would have been unthinkable in Soviet times, when the state, with its ideological cult of “the worker,” denied the very idea of culturally derived identity.

When Siberia's oil lands came under development, native people were forcibly herded into villages and cut off from their hunting and fishing grounds. Following the breakup of the Soviet Union, the nomads won legal status as “aboriginal people,” with the right to roam the oil fields. In spite of their new status and the architectural homage in the capital, their lot has hardly improved. Their numbers are small, about 30,000 in all; their languages are

nearly extinct; and they are heavily afflicted by the scourges of contemporary Russia—AIDS, alcoholism, and tuberculosis. Some oil-tax money is being invested in medical ships that stop along the rivers to care for patients. But critics say these floating clinics diagnose disease, then leave patients with no means to get treatment.

Rural Russia is also being depopulated by the flight of young people to Moscow and other cities. To counter these trends, Filipenko has implemented ambitious plans to turn Khanty-Mansi into a place young people will choose to live in rather than leave. And this effort, he boasts, is working. He notes that Khanty-Mansi has the third highest birthrate among provinces in Russia, and unlike the country as a whole,





whose population is in decline, Khanty-Mansi's has increased 18 percent since 1989, from a combination of births and immigration.

Oil composes 90 percent of the capital's economy, which is not surprising given the surge in oil prices. But it points to a problem shared by all resource-dependent economies: At some point the resource will be exhausted, and new sources of prosperity will have to be found. Recognizing the need to develop economic prospects beyond oil, Filipenko persuaded some 80 top researchers from Akademgorodok—a famed science and research town in southern Siberia created in Soviet times—to move to his regional capital to staff a new institute specializing in information technologies. The institute

provides consulting services to oil companies, but it also takes on projects in unrelated fields such as nanotechnology.

It's the start of a "Silicon Taiga," says Alexander Sherbakov, a 60-year-old mathematician with a gray walrus mustache. As the era of easy oil comes to an end, he says, "we're going to grow our own scholars" by creating information-age jobs for the younger generation. Unlike investment in oil, investment in science, he says, can guarantee an everlasting bright future for the region's economy and its people.

That's undoubtedly an optimistic assessment. For one thing, the touted model, Silicon Valley, is located in temperate California. In Soviet times the Kremlin could simply order top scientists to move to remote research centers. In post-Soviet times Russia's top researchers can live and work wherever they choose, and most are choosing to live in prosperous cities such as Moscow and St. Petersburg.

WHILE THE OIL BOOM has yet to make Siberia a magnet for Russia's knowledge class, it is attracting many other newcomers: impoverished immigrants from beyond Russia's borders. Early one morning, in a vacant lot just off the highway to Filipenko's showcase capital, a group of about 15 shabbily dressed men ranging in age from their 20s to their 40s are waiting for offers of work, however menial. A white Nissan pulls up, and several of the men walk over to talk to the driver, who is looking for a few hands to dig potatoes. But his offering price, just under ten dollars a day, isn't enough, and he drives away without any takers.

These men are what Russians, borrowing a German word, call *gastarbeiters*—guest workers. They are nearly everywhere in Khanty-Mansi. Most are Muslims from Tajikistan, the former Soviet republic in Central Asia whose economy was shattered by civil war in the mid-1990s. They come here in spring and return home before winter arrives. It's not every day they find a job, but when they do they can earn about \$20 lugging bags of cement for a construction crew or doing household cleaning. They wire funds back to their families, and their employers avoid paying taxes on the wages.

The men balk at my request to see their living quarters. One says he is ashamed to show me how he lives. "I don't want you to get the



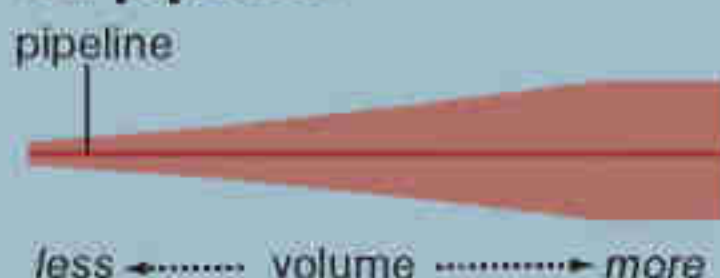
# The Flow of Power

Veining the landscape, pipelines snake from Russia across Europe. Nearly a third of overall European Union crude oil imports—worth some 60 billion dollars—come from Russia. Some nations are more dependent: Poland gets 95 percent of its crude from Russian sources. Russia has flexed its energy muscle in political disputes with former Soviet republics, shutting off supplies—or threatening to do so—during winter.

## Primary Russian oil and gas pipelines to Europe

Based on estimated volume of major pipelines

### Oil pipeline



### Gas pipeline

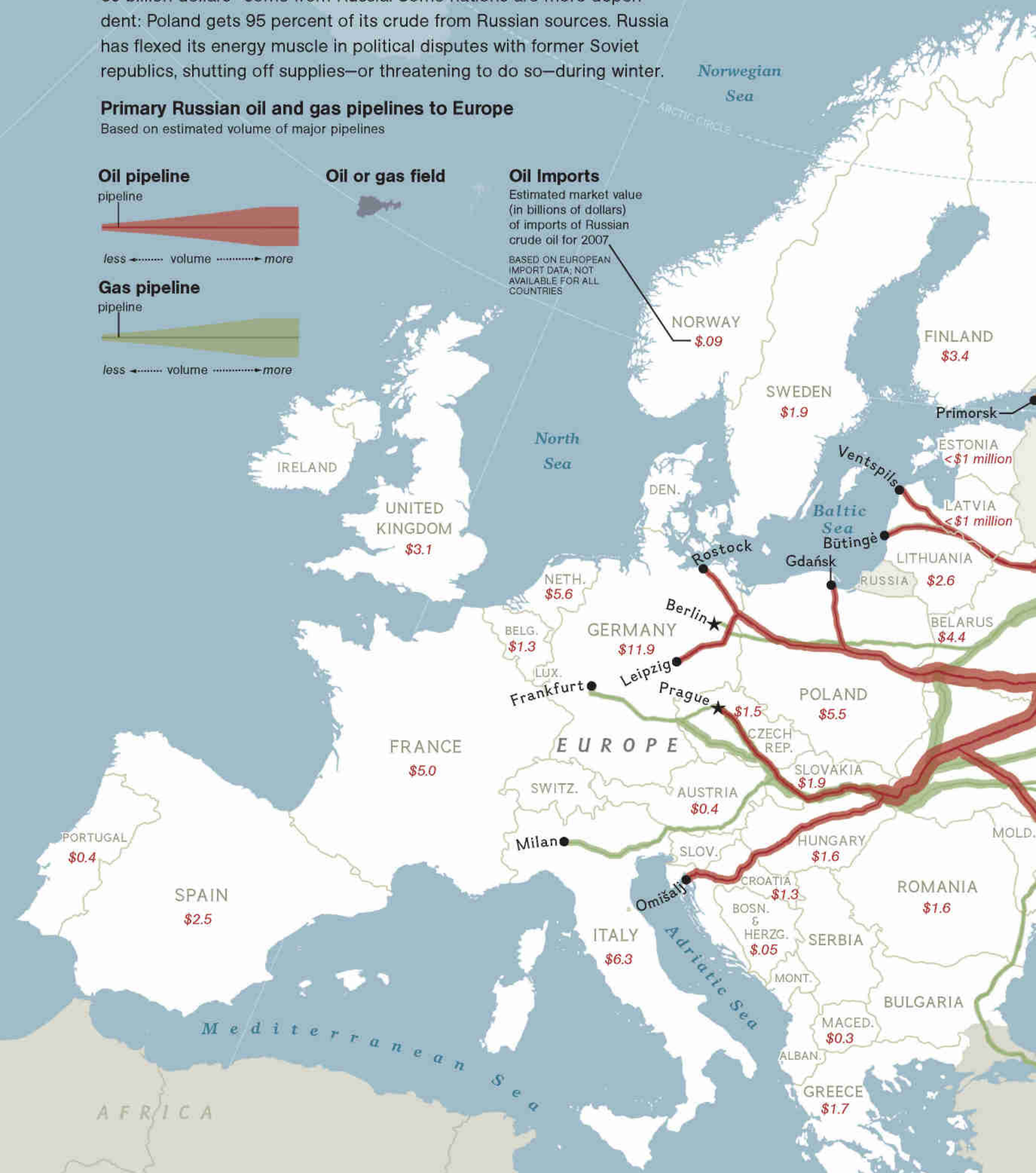


### Oil or gas field

### Oil Imports

Estimated market value (in billions of dollars) of imports of Russian crude oil for 2007

BASED ON EUROPEAN IMPORT DATA; NOT AVAILABLE FOR ALL COUNTRIES









**The *gastarbeiters* (guest workers) are nearly everywhere in Khanty-Mansi. Most are Muslims from Tajikistan, the former Soviet republic whose economy was shattered by civil war.**

wrong idea," he says. "We are not bandits; we are civilized people. We just need work."

The men are supposed to obtain registration papers certifying their place of residence, but, as they tell me, they have no authorized place to live, bunking instead in unheated garages illegally rented to them. A work boss—a kind of Mafia figure—obtains papers for them by bribing the registration office, but those documents, listing a false address, leave the *gastarbeiters* at the mercy of the police. When they are found out, they're sometimes forced to pay a spot "fine" (read "bribe"), and repeat offenders may face deportation. Russia's federal government recently put the burden on employers to register the workers and check their identifications, but such measures are unlikely to stem the tide so long as the oil boom continues.

A FLOOD OF RUSSIANS from economically depressed cities west of the Urals is also swelling the oil towns of western Siberia. Forty years ago Surgut was a collection of wooden hovels, in a place where temperatures can plunge to minus 60 degrees Fahrenheit and midwinter darkness lasts for all but a few hours a day. Today Surgut is one of western Siberia's largest cities, with 300,000 people. The new arrivals are voting with their feet, a sign that Russia's new market economy is actually working.

The polish and prosperity on view in Surgut were once unthinkable in Russia's hinterlands. A combined day care and preschool the city recently remodeled with 5.2 million dollars largely from oil revenue now has a heated indoor swimming pool and hydromassage whirlpool; an animal collection with rabbits, turtles, and parrots; and a room with a small wooden stage on which colorfully costumed children diligently

perform fairy tales. When weather doesn't permit outdoor exercise, the children can ride around in toy cars in a large, glass-enclosed playroom kept at a moderately chilled temperature. And then the toddlers can be soothed by a hot drink from the herbal tea bar.

I understand that the "foreigner" is being shown the finest kindergarten in town, but only so much can be faked. Stuck in Surgut's traffic jams are as many Hondas, Toyotas, and Nissans as inexpensive Russian-made Ladas. Two-car families are becoming more common with the rise in living standard.

The housing stock of a typical Russian city consists of large (and ugly) multistoried concrete apartment blocks. Surgut boasts a suburban development of single-family town houses, aimed at a new upper middle class of oil company managers, bankers, and entrepreneurs. The red-brick houses, each with its own small plot of land, are being built along a tree-lined stretch of riverfront at an average cost of \$400,000. Envious townspeople coined an ironic sobriquet for the elite community: *Dolina Nischikh*, Valley of the Beggars.

Surgut might have fallen apart, as did some other Russian cities, in the chaos following the collapse of the Soviet Union. That it didn't is a testament to the rootedness and stability of its political and business leadership.

"I was born in Surgut, my children were born here, and my grandchildren were born here," Alexander Sidorov, the city's longtime mayor, proudly declares. Surgut's economic anchor, the oil company Surgutneftegas, Russia's fourth largest producer, is majority owned by local managers. And unlike most Russian oil barons, who rule their western Siberian empires from Moscow, Surgutneftegas's general director, billionaire Vladimir Bogdanov, makes his home in town. Though now a towering figure in Surgut, Bogdanov started out as a common neftyanik.

Surgutneftegas is using the oil boom to finance an ambitious modernization program. At the oil field management center, computer engineers have custom designed an enormous digital map to monitor and adjust the field's performance. The map displays real-time information sent by coded radio signal from pump stations, active wells, and pipelines. From this display, managers can tell how much electric power is being





**COLD WELCOME:** Despite a growing need for workers, Russia is tightening its strictures on immigration. In the regional capital of Khanty-Mansiysk, federal officers inspect laborers' documents (top). Illegal workers face arrest (above), fines, and deportation. Employers can also be penalized as much as \$30,000 for each worker. But lured by the prospect of lucrative jobs in a flourishing economy, guest workers from poor ex-Soviet republics continue to pour into Siberia.





**BRIGHT APARTMENTS** have replaced drab relics in Nizhnevartovsk, heart of oil country, and more will be needed to accommodate an expanding population. Over the next few years the city plans to spend nearly a billion dollars on new housing.









**A NEW DAY** begins for Andrey Patrikeyev and wife, Irina. "We now live in nice houses, enjoy galleries," says the well-off bureaucrat. "The oil industry pushed development."

consumed, whether a well needs repairs, and whether a pipeline is leaking.

Protection of the environment, barely a concern in Soviet times, is becoming part of the new ethos. It's not that the oil industry has suddenly become softhearted toward flora and fauna. Rather, high oil prices provide an incentive to minimize waste, as do license agreements that include big fines for spills. Moreover, as Russian oil firms have become global players, they've also become more sensitive to international concerns about the environment. "Maintaining a good reputation is very important," says Alexey Knizhnikov of the World Wildlife Fund in Moscow. "Otherwise, doing business becomes difficult."

Lubov Malyshkina, director of the environmental department at Surgutneftgas, is a chemical engineer with an advanced degree in the science of corrosion protection and geoecology. She also serves as an elected official in the regional parliament. In Soviet times, she says, the oil ministry in Moscow, oblivious to local conditions, would send chemicals that proved useless to treat oil spills and other hazards. Now Malyshkina's department, drawing on a nearly 500-million-dollar budget, makes its own purchases. She shows me one: a Swedish-made Truxor vehicle with tanklike treads that break up oil-saturated peat so that spills can be cleaned up. The company is also investing five million dollars in a new plant for recycling





old tires into fibers that can be mixed into the asphalt used to pave company roads.

One aspect of the oil industry here hasn't changed: The *neftyanik's* job is still hazardous and grueling. At a rig about an hour's drive from Surgut, villagers gathering mushrooms are dwarfed by massive pumps, whose rhythmic motion suggests a giant bird dipping its beak to the soil. Metal stairs slick with oil lead to a platform where a drill is boring through rock with a diamond-coated bit nearly a foot in diameter. It's noisy and the air is foul, but this is a good spot to be in winter, I'm told, because the platform is bathed in steam. The men work eight-hour shifts for up to 30 straight days, sleeping on-site in trailer wagons, then

rest off-site for up to 30 days. Alcohol is strictly forbidden. Drink all you want during your rest, the men are told, but return sober.

Yet the jobs are a route to a prosperity unimaginable a few years ago. The least experienced workers get a monthly salary of \$1,000, the most senior hands as much as \$4,000. And there are bonuses for exceeding daily quotas. A thrifty *neftyanik* can save enough to purchase a flat in Surgut's apartment complexes—if not a town house in the Valley of the Beggars.

All of this is impressive, of course. But the larger question for Surgutneftegas, and every oil firm in Khanty-Mansi, is whether they can rise to the myriad political, economic, and technical challenges on the horizon. While most analysts expect western Siberia to remain the dominant source of Russia's oil for at least the next 20 years, the region's oil fields are aging. Coaxing additional barrels of oil from the ground is becoming more difficult and expensive, and maintaining production will require infusions of capital and expertise from sources outside Russia. But burdensome taxes—all gross revenues above \$25 a barrel go to the federal government—and Kremlin-backed power plays have chilled the investment climate like a Siberian blizzard. One need only visit Nefteyugansk, a city of 114,000 on the Ob River about an hour's drive from Surgut, to see why.

A BLACK GUSHER OF TROUBLE is what the oil boom has been for Nefteyugansk, which has the look and feel of an unkempt industrial park. The central plaza is strewn with iron pipes, and down by the river a crumpled barrel of Shell oil floats next to a dilapidated dock. A few paces inside the gate of the town's cemetery lies the grave of Vladimir Petukhov, the burial ground's most famous resident. In 1996 the townspeople elected Petukhov as their mayor. Two years later, as he walked to work on a June morning, he was shot to death by a pair of gunmen. An etching on his black marble gravestone depicts him in a crewneck sweater and leather jacket.

For more than ten years oil has been at the center of a violent and chaotic power struggle in Nefteyugansk. The difficulties began in the mid-1990s, when a *nouveau riche* Moscow banker snagged one of Russia's prime oil producers—and the town's sole large employer—in a privatization auction. The banker, Mikhail





**A LIGHT-UP PALM TREE** lures cold-weary Russians to a Surgut travel agency selling trips to seductively warm destinations: Egypt, Spain, Turkey. Symbols of success and a heated appetite for luxury, groves of bright green palms decorate discos, casinos, and billboards across western Siberia. In Khanty-Mansiysk the swagger of youth and new money keeps the dance floor busy at *Territoriya Pervykh*—“champions’ territory”—often until five o’clock in the morning.



**Forty years ago Surgut was a collection of wooden hovels, in a place where severe winter lasts four months. Today it is one of Siberia's largest cities, with 300,000 people.**

Khodorkovsky, made the Nefteyugansk unit the core subsidiary in his new oil company, known as Yukos. But he antagonized the city by delaying tax payments, causing city workers to go unpaid for months. Mayor Petukhov, a former neftyanik, led public protests against the new Moscow owners, who, he said, “spit into our faces, the faces of oilers.” The mayor’s murder, at the age of 48, outraged the townspeople, many of whom connected the deed to his stand against Yukos. “This blood is on your hands,” read anti-Yukos banners put up at city hall by Petukhov’s mourners.

For five years no one was brought to justice. During this time the city was governed by a corrupt official who eventually was sent to jail for swindling oil workers out of their promised retirement homes in Russia’s balmy Black Sea region. Oil prices, meanwhile, went ever higher, inflating the value of Khodorkovsky’s holdings. And then the hammer came down.

In June 2003, Moscow prosecutors arrested Yukos’s security chief on charges of organizing the execution of Petukhov. Four months later they arrested Khodorkovsky on charges of fraud and tax evasion. Tax authorities seized the Nefteyugansk subsidiary and handed it over to a Kremlin-controlled company called Rosneft. Khodorkovsky was convicted and carted off to jail in southeastern Siberia, where his face was slashed by an inmate. Meanwhile, the security chief was convicted in a trial heavily publicized on state television. In the latest development, prosecutors announced last February that Yukos co-owner Leonid Nevzlin also would be charged in Petukhov’s murder.

Perhaps it did happen the way the government claimed, but ask folks in Nefteyugansk about the murder, and they tend to shrug and say they don’t know what to believe. The coordinated elements of the Yukos affair have the whiff of a Moscow plot hatched by the KGB types in control of the Kremlin. The result, in any case, is that a cash cow—and still the town’s livelihood—has passed from the hands of a Moscow oligarch into the hands of the Kremlin.

When I show up in town, Sergey Burov has been mayor for four months. He was once a deputy director for Rosneft and before that a senior manager for Yukos. He, too, is no stranger to violence: In 2005, while walking to his car in the morning, he took a bullet to the stomach. It

looked like another contract job, but prosecutors closed the case without finding a culprit.

Burov is a burly man whose wide shoulders stretch his suit. He is interested in talking about the town’s future, not its bloody past. In partnership with Rosneft, he tells me, the city administration has ambitious plans to redevelop Nefteyugansk. Come back in two years, he says, and I will see an entirely different town, maybe even a yacht club. After the interview his press secretary shows off an indoor sports facility with an Olympic-size swimming pool. In the central plaza, the one littered with pipe just a few days earlier, workers are starting to install brick walkways and flower beds.

Are things finally looking up for Nefteyugansk? Residents seem skeptical. “Maybe Rosneft feels better being here,” Vasily Voroshilov, a 52-year-old oil well repairman, says. “But we don’t feel it.”

That skepticism is shared by many observers outside Russia, who say it’s one thing to seize control of an oil company and quite another to run it. Says one analyst of the Kremlin’s takeover of Russian oil, “You can steal a Chevy, but that doesn’t mean you know how to drive it.”

FOR ALL THE WEALTH that oil can produce, it is often as much a curse as a blessing for countries such as Russia. Early in the 1990s, before the oil boom, Boris Yeltsin encouraged local provinces to grab what autonomy they could. This was when Russia’s potential for political pluralism and Western-style grassroots democracy looked greatest. When oil prices rose toward the end of the decade, the Kremlin realized that this source of wealth could be used to bring about a humiliated Russia’s global resurgence. Salvation by oil has since become an article of national faith.



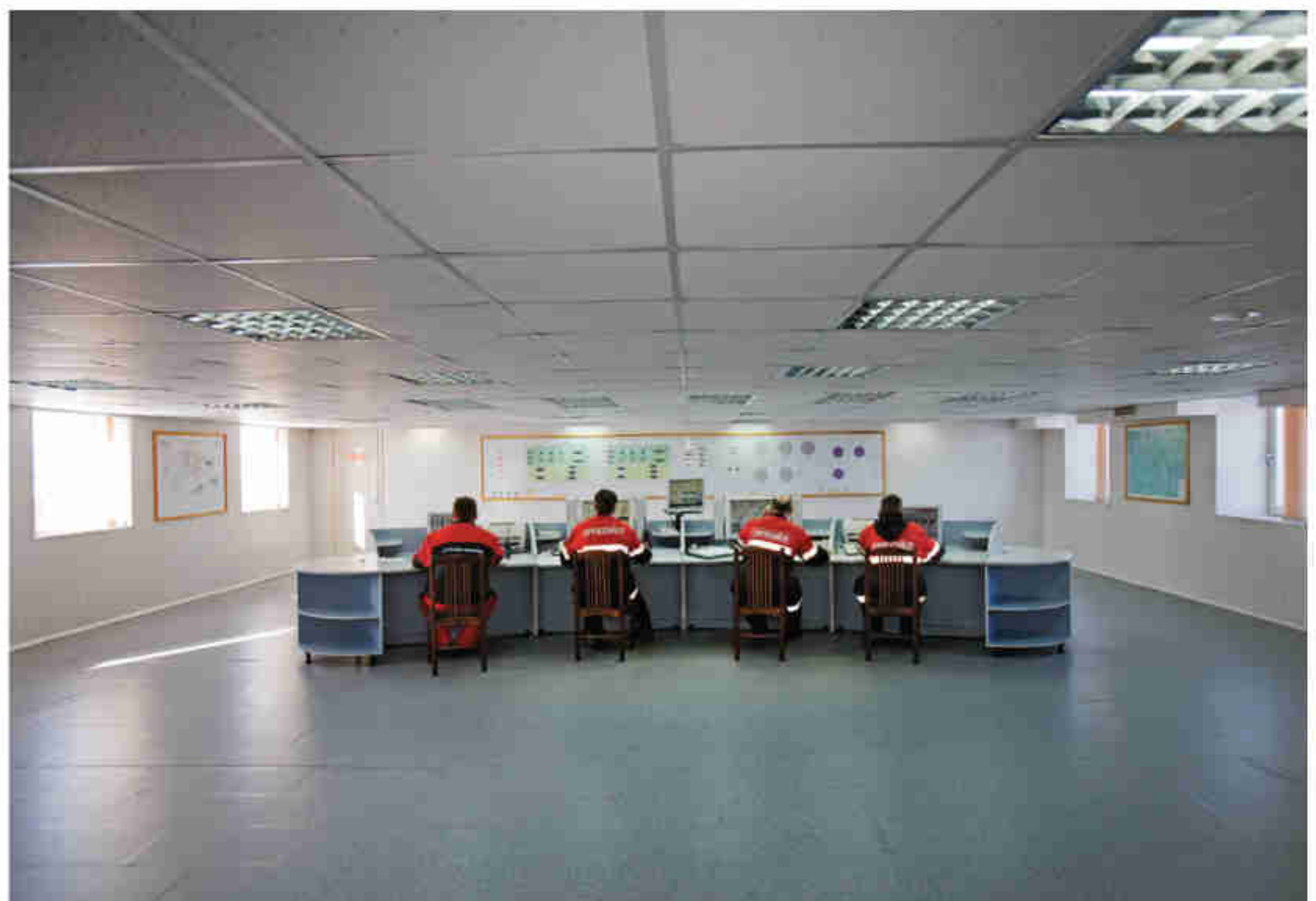


**A DRILL PAD** built on top of fragile wetlands probes for new oil reserves. Technology imported from the West is helping Russia's oil industry modernize, but Soviet-era spills and pipeline breaks have contaminated much of the region.









**HEROIC OIL**, sculpted in bronze and titled “Drop of Life,” stands in Kogalym. It was given to the city by Lukoil, Russia’s largest private oil company, in 2001, the tenth anniversary of the company’s founding. While tolerating private firms, the national government is tightening its control of the industry, worrying some experts. Still, from the sleek interior of a well control center at the South Yagunskoye field, Lukoil’s future, like that of Russia’s new economy, seems bright—for now.



"Oil," said a 16-year-old student at Khanty-Mansiysk's school for math whizzes, "is the only way for our country to stand up, to survive." Actually, there are many ways that the Russians, a creative and educated people, can revive their country. But oil suggests national potency, and Russia's petroleum patrimony lends itself to patriotic incantations of an almost mystical kind. At the festivities on Oilers' Day one of the songs, a salute to the collective might of the neftyaniki, proclaimed, "We are the fingers pressed tightly into a fist."

"Russia's superpower status today comes from energy, not its military," says Julia Nanay, a senior director at PFC Energy, a global consultancy based in Washington, D.C. "The Kremlin determines what happens with oil in western Siberia. They want to control production and exports in order to maximize Russia's geopolitical relevance."

Just as the tsars of old exercised monopolies on valuable commodities such as fur and salt, the Kremlin wants direct control over oil—and over the oligarchs who produce it. Those who come to heel survive; those who don't risk suffering Khodorkovsky's fate, or worse.

One of the survivors is Vagit Alekperov, president of Russia's biggest private oil company, Lukoil. Starting out working on the rigs near his native Baku, Alekperov was sent to Siberia in the late 1970s to manage an oil-production team. A notoriously strict paternalist, he angered his men by banning the sale of alcohol in the village. Several of them grabbed hunting rifles and fired shots at his cabin, but Alekperov, ever the survivor, wasn't there at the time.

During the final days of the Soviet Union, Alekperov forged Lukoil from prime oil assets in western Siberia. Today the company is a global multinational with hydrocarbon reserves second only to ExxonMobil—and some 2,000 gas stations in the U.S. Though most of Lukoil's reserves are in western Siberia, Alekperov keeps his headquarters just two miles from the Kremlin. Like other survivors, he knows that he must be attentive to any change in political mood that could affect Lukoil's fortunes, for better or worse.

A distinguished-looking man with bronze skin and a crop of steel gray hair, Alekperov dresses in impeccably tailored suits. A tough guy, he can also charm. When pressed on

**"Russia's superpower status today comes from energy, not its military. The Kremlin determines what happens with oil in western Siberia."**

—JULIA NANAY, ANALYST

whether oil consumers around the world should feel comfortable now that Russia has a large finger on the globe's petroleum tap, he leaned back in his chair, smiled expansively, and asked, "Do I look like a bear?" I couldn't help laughing. "We just want to make money."

Having gobbled up Yukos, might the Kremlin want to swallow Lukoil next? "I don't think either the government or the president of Russia will target such a company," Alekperov remonstrates. I decide not to mention that Khodorkovsky had told me the same thing not long before his arrest.

Lukoil's base of operations in Khanty-Mansi is the town of Kogalym. A roadside floral arrangement spells out the company's name not far from the golden domes of a Russian Orthodox cathedral and the green minaret of a mosque. At a refurbished maternity house—what Russians call a *roddom*—Dr. Galina Pustovit, director of the gynecology department, shows off new Western-standard medical equipment. In a country where many women deliver their babies in Soviet-era buildings reeking of sour cabbage and damp concrete, this gleaming facility rates four stars.

When I mention to Pustovit that Russia's oil industry is known for being corrupt, the doctor gives me a sharp look. "This is oil," she says, sweeping a hand around the gynecology ward. "Oilers built this hospital. All of the objects in this city have been built with oil money, including our beautiful boulevard." Don't judge us too harshly, her look says: Life in these parts has never been better. □

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✦ **Siberian Spring** See more of Gerd Ludwig's images of Russia's hinterland in the bloom of an oil bonanza at [ngm.com](http://ngm.com).









**World oil demand  
is surging as  
supplies approach  
their limits.**

IN 2000 A SAUDI OIL GEOLOGIST named Sadad I. Al Hussein made a startling discovery. Hussein, then head of exploration and production for the state-owned oil company, Saudi Aramco, had long been skeptical of the oil industry's upbeat forecasts for future production. Since the mid-1990s he had been studying data from the 250 or so major oil fields that produce most of the world's oil. He looked at how much crude remained in each one and how rapidly it was being depleted, then added all the new fields that oil companies hoped to bring on line in coming decades. When he tallied the numbers, Hussein says he realized that many oil experts "were either misreading the global reserves and oil-production data or obfuscating it."

# Tapped Out

Where mainstream forecasts showed output rising steadily each year in a great upward curve that kept up with global demand, Hussein's calculations showed output leveling off, starting as early as 2004. Just as alarming, this production plateau would last 15 years at best, after which the output of conventional oil would begin "a gradual but irreversible decline."

That is hardly the kind of scenario we've come to expect from Saudi Aramco, which sits atop the world's largest proven oil reserves—some 260 billion barrels, or roughly a fifth of the world's known crude—and routinely claims that oil will remain plentiful for many more decades. Indeed, according to an industry source, Saudi oil minister Ali al-Naimi took a dim view of Hussein's report, and in 2004 Hussein retired from Aramco to become an industry consultant. But if he is right, a dramatic shift lies just ahead for a world whose critical systems, from defense to transportation to food production, all run on cheap, abundant oil.

Hussein isn't the first to raise the specter

**BY PAUL ROBERTS**

From a drilling platform off Newfoundland to a bustling gas station in Lianyungang, China, oil addiction is driving us to search farther and spend more for fuel.



of a peak in global oil output. For decades oil geologists have theorized that when half the world's original endowment of oil has been extracted, getting more out of the ground each year will become increasingly difficult, and eventually impossible. Global output, which has risen steadily from fewer than a million barrels a day in 1900 to around 85 million barrels today, will essentially stall. Ready or not, we will face a post-oil future—a future that could be marked by recession and even war, as the United States and other big oil importers jockey for access to secure oil resources.

Forecasts of peak oil are highly controversial—not because anyone thinks oil will last forever, but because no one really knows how much oil remains underground and thus how close we are to reaching the halfway point. So-called oil pessimists contend that a peak is imminent or has actually arrived, as Hussein believes, hidden behind day-to-day fluctuations in production. That might help explain why crude oil prices have been rising steadily and topped a hundred dollars a barrel early this year.

Optimists, by contrast, insist the turning point is decades away, because the world has so much oil yet to be tapped or even discovered, as well as huge reserves of “unconventional” oil, such as the massive tar-sand deposits in western Canada. Optimists also note that in the past, whenever doomsayers have predicted an “imminent” peak, a new oil-field discovery or oil-extraction technology allowed output to keep rising. Indeed, when Hussein first published his forecasts in 2004, he says, optimists dismissed his conclusions “as curious footnotes.”

Many industry experts continue to argue that today's high prices are temporary, the result of technical bottlenecks, sharply rising demand

from Asia, and a plummeting dollar. “People will run out of demand before they run out of oil,” BP's chief economist declared at a meeting early this year. Other optimists, however, are wavering. Not only have oil prices soared to historic levels, but unlike past spikes, those prices haven't generated a surge in new output. Ordinarily, higher prices encourage oil companies to invest more in new exploration technologies and go after difficult-to-reach oil fields. The price surge that followed the Iran-Iraq war in the 1980s, for example, eventually unleashed so much new oil that markets were glutted. But for the past few years, despite a sustained rise in price, global conventional oil output has hovered around 85 million barrels a day, which happens to be just where Hussein's calculations suggested output would begin to level off.

The change is so stark that the oil industry itself has lost some of its cockiness. Last fall, after the International Energy Agency released a forecast showing global oil demand rising more than a third by 2030, to 116 million barrels a day, several oil-company executives voiced doubts that production could ever keep pace. Speaking to an industry conference in London, Christophe de Margerie, head of the French oil giant Total, flatly declared that the “optimistic case” for maximum daily output was 100 million barrels—meaning global demand could outstrip supply before 2020. And in January, Royal Dutch Shell's CEO, Jeroen van der Veer, estimated that “after 2015 supplies of easy-to-access oil and gas will no longer keep up with demand.”

To be sure, veteran oilmen like de Margerie and van der Veer don't talk about peak oil in a geologic sense. In their view, political and economic factors above ground, rather than geologic ones below, are the main obstacles to raising output. War-torn Iraq is said to have huge underground oil reserves, yet because of poor security, it produces about a fifth as much



#### PEAK OIL

How much oil remains in the Earth cannot be known. But even the most optimistic scenarios hold that before mid-century we will hit peak oil, the point at which half the world's supply has been extracted.

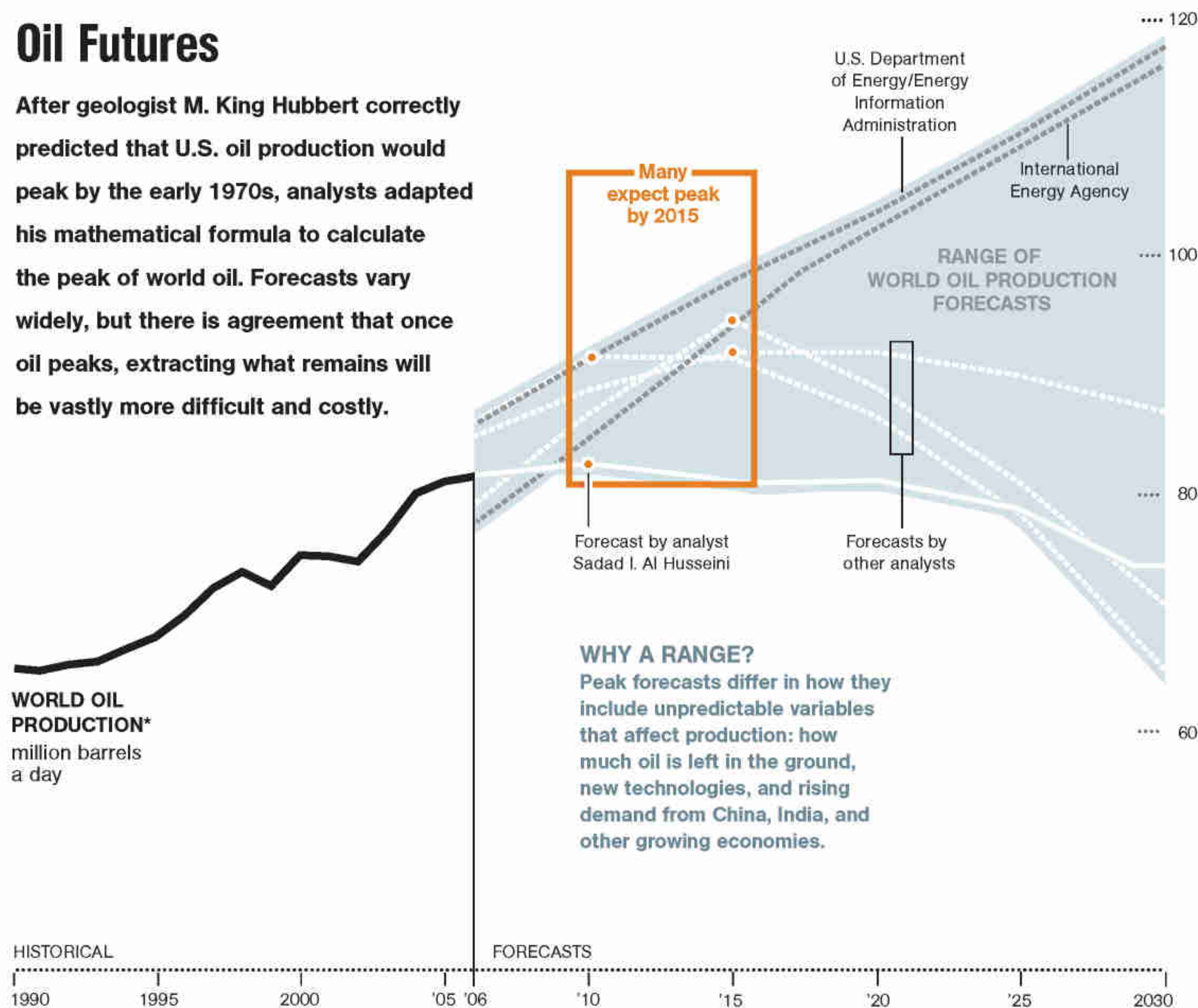
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*Paul Roberts is author of The End of Oil, published in 2004. His new book, The End of Food, will be out this summer from Houghton Mifflin Harcourt.*



# Oil Futures

After geologist M. King Hubbert correctly predicted that U.S. oil production would peak by the early 1970s, analysts adapted his mathematical formula to calculate the peak of world oil. Forecasts vary widely, but there is agreement that once oil peaks, extracting what remains will be vastly more difficult and costly.

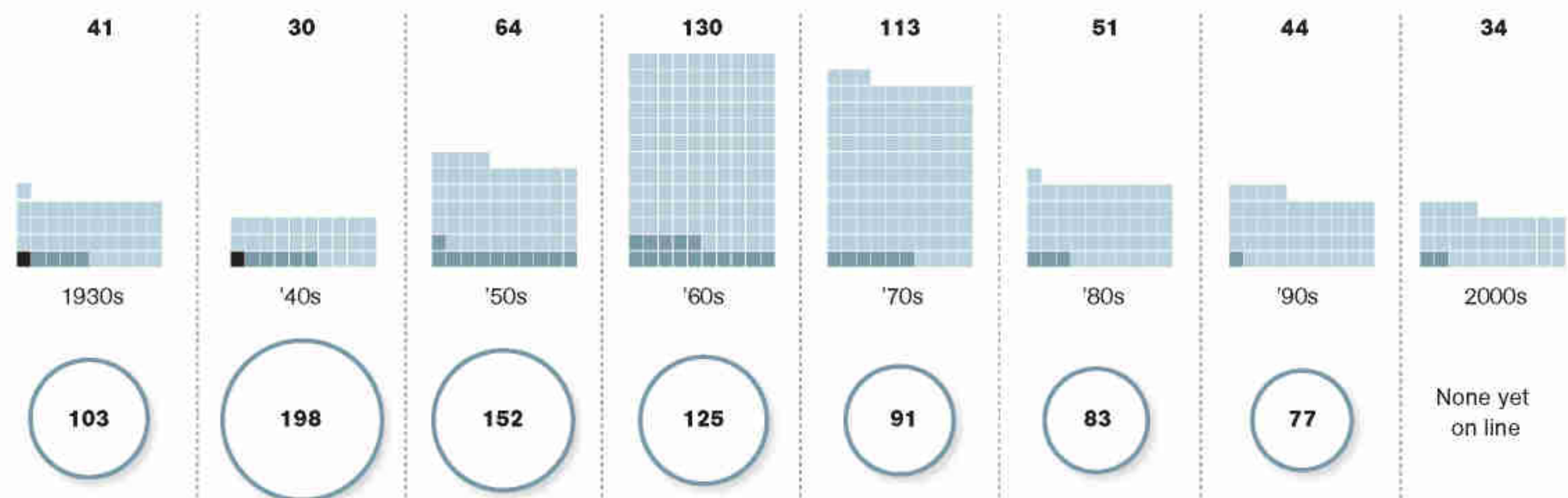


## Draining the Reliable Giants

More than a third of the world's oil comes from large fields, relatively easy to tap. But discovery of new giants, and average production for each field, has declined for decades. The largest single producer remains a Saudi Arabia megagiant found in the 1940s.

### LARGE OIL-FIELD DISCOVERIES

- Giant: 500 million to 5 billion barrels
- Supergiant: 5 billion to 50 billion barrels
- Megagiant: Over 50 billion barrels



### CURRENT AVERAGE PRODUCTION PER FIELD thousands of barrels a day

\*WORLD OIL PRODUCTION INCLUDES CRUDE OIL, NATURAL GAS PLANT LIQUIDS, OTHER LIQUIDS, AND REFINERY PROCESSING GAINS OR LOSSES.

HIRAM HENRIQUEZ, NG STAFF

SOURCES: BRITISH PETROLEUM; M. K. HORN; NATIONAL PETROLEUM COUNCIL; PEAK OIL NETHERLANDS FOUNDATION



as Saudi Arabia does. And in countries such as Venezuela and Russia, foreign oil companies face restrictive laws that hamper their ability to develop new wells and other infrastructure. “The issue over the medium term is not whether there is oil to be produced,” says Edward Morse, a former State Department oil expert who now analyzes markets for Lehman Brothers, “but rather how to overcome political obstacles to production.”

Yet even oil optimists concede that physical limits are beginning to loom. Consider the issue of discovery rates. Oil can’t be pumped from the ground until it has been found, and yet the volume discovered each year has steadily fallen

Ghawar, which held about 120 billion barrels at its discovery in 1948.

Smaller fields also cost more to operate than larger ones do. “The world has zillions of little fields,” says Matt Simmons, a Houston investment banker who has studied the oil discovery trend. “But the problem is, you need a zillion oil rigs to get at them all.” This cost disparity is one reason the industry prefers to rely on large fields—and why they supply more than a third of our daily output. Unfortunately, because most of the biggest finds were made decades ago, much of our oil is coming from mature fields that are now approaching their peaks, or are even in decline; output is plummeting in

## Other options

As liquid oil becomes more costly and hard to find, researchers ...and entrepreneurs are searching for ways to squeeze fuel from alternative sources.



### BIOFUELS

Renewable fuels made from grains, stalks, and plant oils may help offset some of our oil appetite. Already, corn-based ethanol is a popular but controversial additive to gasoline.



### COAL TO OIL

Under great pressure and high temperatures, coal—a relatively abundant resource—can be liquefied into fuel. But the process remains expensive and emits large amounts of carbon dioxide.



### TAR SANDS

Tar can be extracted from the sands, found in large deposits in western Canada, and turned into crude oil. The process requires huge amounts of water and energy, often from natural gas.

since the early 1960s—despite dazzling technological advances, including computer-assisted seismic imaging that allows companies to “see” oil deep below the Earth’s surface. One reason for the decline is simple mathematics: Most of the big, easily located fields—the so-called “elephants”—were discovered decades ago, and the remaining fields tend to be small. Not only are they harder to find than big fields, but they must also be found in greater numbers to produce as much oil. Last November, for example, oil executives were ecstatic over the discovery off the Brazilian coast of a field called Tupi, thought to be the biggest find in seven years. And yet with as much as eight billion barrels, Tupi is about a fifteenth the size of Saudi Arabia’s legendary

once prolific regions such as the North Sea and Alaska’s North Slope.

Worldwide, output from existing fields is falling by as much as 8 percent a year, which means that oil companies must develop up to seven million barrels a day in additional capacity simply to keep current output steady—plus many more millions of barrels to meet the growth in demand of about 1.5 percent a year. And yet, with declining field sizes, rising costs, and political barriers, finding those new barrels is getting harder and harder. Many of the biggest oil companies, including Shell and Mexico’s state-owned Pemex, are actually finding less oil each year than they sell.

As more and more existing fields mature,





Bright as a bull's-eye, a tanker cruises the English Channel. As the struggle for oil intensifies, experts worry crucial infrastructure, including pipelines, rigs, and ships, could provide easy targets for terrorists.

and as global oil demand continues to grow, the deficit will widen substantially. By 2010, according to James Mulva, CEO of ConocoPhillips, nearly 40 percent of the world's daily oil output will have to come from fields that have not been tapped—or even discovered. By 2030 nearly all our oil will come from fields not currently in operation. Mulva, for one, isn't sure enough new oil can be pumped. At a conference in New York last fall, he predicted output would stall at 100 million barrels a day—the same figure Total's chief had projected. “And the reason,” Mulva said, “is, where is all that going to come from?”

Whatever the ceiling turns out to be, one prediction seems secure: The era of cheap oil is behind us. If the past is any guide, the world may be in for a rough ride. In the early 1970s, during the Arab oil embargo, U.S. policymakers considered desperate measures to keep oil supplies flowing, even drawing up contingency plans to seize Middle Eastern oil fields.

Washington backed away from military action then, but such tensions are likely to reemerge. Since Saudi Arabia and other members of the Organization of Petroleum Exporting Countries control 75 percent of the world's total oil reserves, their output will peak substantially

later than that of other oil regions, giving them even more power over prices and the world economy. A peak or plateau in oil production will also mean that, with rising population, the amount of gasoline, kerosene, and diesel available for each person on the planet may be significantly less than it is today. And if that's bad news for energy-intensive economies, such as the United States, it could be disastrous for the developing world, which relies on petroleum fuels not just for transport but also for cooking, lighting, and irrigation.

Husseini worries that the world has been slow to wake up to the prospect. Fuel-efficient cars and alternatives such as biofuels will compensate for some of the depleted oil supplies, but the bigger challenge may be inducing oil-hungry societies to curb demand. Any meaningful discussion about changes in our energy-intensive lifestyles, says Husseini, “is still off the table.” With the inexorable arithmetic of oil depletion, it may not stay off the table much longer. □

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➤ **After Oil** What fuels will drive the world economy if rising demand for oil outpaces supply? Find out more at [ngm.com](http://ngm.com).



# livingcolor

Toxic nudibranchs—soft, seagoing slugs—produce a brilliant defense.

PHOTOGRAPHS BY DAVID DOUBILET







NEMBROTHA KUBARYANA - 2.4 INCHES (6 CENTIMETERS)







Built to feed exclusively on corals like this spindly gorgonian, a translucent 1.7-inch-long *Phyllodesmium iriomotense* houses its branching digestive gland within tentacle-like cerata—outgrowths the animal can shed if under attack. This species is one of the few colorless nudibranchs.





## Nudibranchs crawl through life as slick and naked as a newborn.

Snail kin whose ancestors shrugged off the shell millions of years ago, they are just skin, muscle, and organs sliding on trails of slime across ocean floors and coral heads the world over.

Found from sandy shallows and reefs to the murky seabed nearly a mile down, nudibranchs thrive in waters both warm and cold and even around billowing deep-sea vents. Members of the gastropod class, and more broadly the mollusks, the mostly finger-size morsels live fully exposed, their gills forming tufts on their backs. (Nudibranch means “naked gill,” a feature that separates them from other sea slugs.) Although they can release their muscular foothold to tumble in a current—a few can even swim freely—they are rarely in a hurry.

So why, in habitats swirling with voracious eaters, aren't nudibranchs picked off like shrimp at a barbecue? The 3,000-plus known nudibranch species, it turns out, are well equipped to defend themselves. Not only can they be tough-skinned, bumpy, and abrasive, but they've also traded the family shell for less burdensome weaponry: toxic secretions and stinging cells. A few make their own poisons, but most pilfer from the foods they eat. Species that dine on toxic sponges, for example, alter and store the irritating compounds in their bodies and secrete them from skin cells or glands when disturbed. Other nudibranchs hoard capsules of tightly coiled stingers, called nematocysts, ingested from fire corals, anemones, and hydroids. Immune to the sting, the slugs deploy the stolen artillery along their own extremities.

Many mobile nudibranchs—vulnerable as they move in daylight between feeding spots—announce their weapons with garish colors and

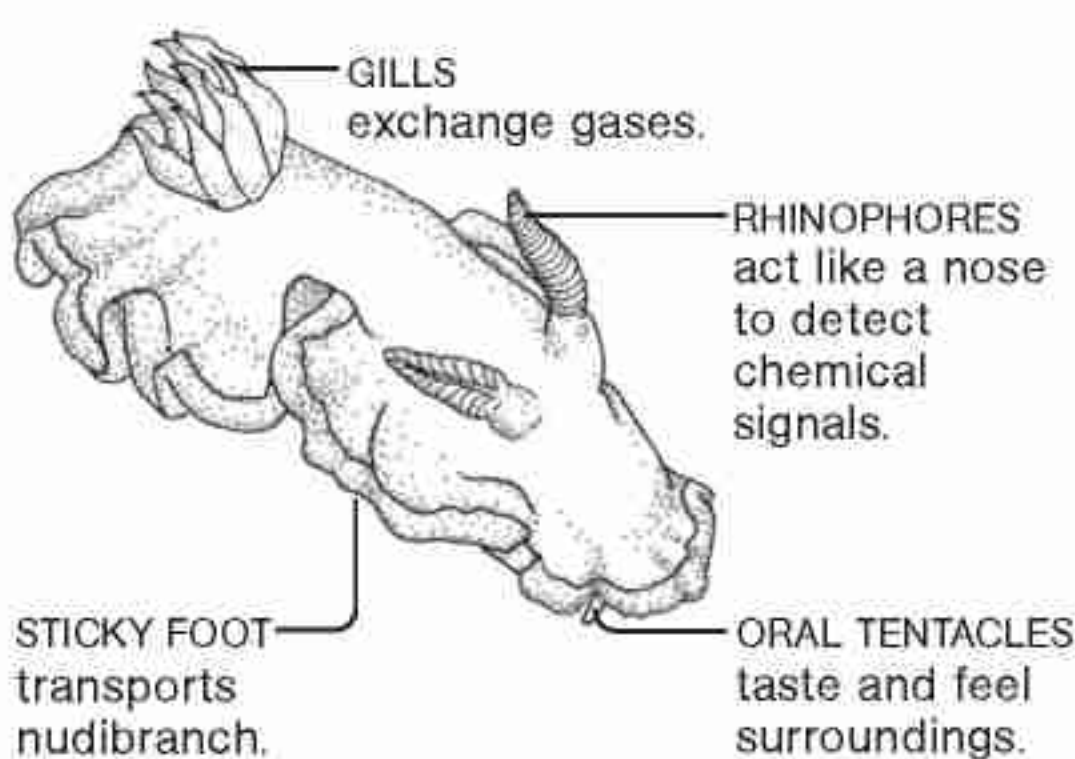
designs, a palette millions of years in the making. Contrasting pigments make them highly visible against a reef's greens and browns, a visual alarm that turns predators wary—bold nibblers quickly learn to avoid the color patterns that announce unpalatable flesh. Animals able to mimic the designs, including nontoxic nudibranchs and other invertebrates like flatworms, are similarly left alone.

More reclusive nudibranchs, with nocturnal habits or small ranges, may opt for camouflage, from drab to brilliant, rather than contrast (although many of these, too, have toxic defenses). Pigments matching sponges and other edible substrates on which they linger can make even the biggest slug varieties—the length of a man's forearm—vanish where they lie.

Even the most keen-eyed diver may miss those cryptic species. But the brazen ones pop into view in bursts of Crayola colors, one munching coral, another glomming on to a rock face, a third riding a current along the seabed. A lucky sighting is a mass aggregation of dozens or even hundreds gathered at a food-rich locale to feed and mate, or a plate-size “solar powered” species that gets nutrients from photosynthetic algae farmed within its body.

Nudibranchs are blind to their own beauty, their tiny eyes discerning little more than light and dark. Instead the animals smell, taste, and feel their world using head-mounted sensory appendages called rhinophores and oral tentacles. Chemical signals help them track food—

**Anatomy of a Nudibranch** (*Glossodoris averni*)







*Bornella anguilla* flees danger by folding in its appendages and swimming like an eel. 2.8 IN (7 CM)

not just coral and sponges but barnacles, eggs, or small fish—and one another. Hermaphroditic, nudibranchs have both male and female organs and can fertilize one another, an ability that speeds the search for mates and doubles reproductive success. Depending on the species, pairs may lay eggs in coils, ribbons, or tangled clumps, up to two million at a time.

Not all adult encounters have such a fruitful outcome. Sometimes one nudibranch eats the other, particularly if it is of another species. A cannibal slug rears up like a cobra to engulf its kin, using jaws and teeth to finish the job. Other nudibranchs rely on enzymes, rather than teeth, to break down prey. What else can devour a nudibranch without ill consequence? Certain fish, sea spiders, turtles, sea stars, a few crabs. Some people consume them as well, after removing the toxic organs. Chileans and islanders off Russia and Alaska roast or boil sea slugs or eat them raw. (Photographer David Doubilet likened the experience to “chewing an eraser.”)

Humans have also studied sea slugs’ simple nervous systems for clues to learning and

memory and have raided their chemical armory in search of pharmaceuticals. Fashioning remedies from marine invertebrates has a long history: Pliny the Elder, for example, wrote in the first century A.D. of using ground snails mixed with honey to treat “ulcerations of the head” and sea urchin ashes for baldness. Scientists today are isolating chemicals that may help ailing heart, bone, and brain. A sea hare (cousin to the nudibranch) recently offered up a cancer-fighting compound that made it into clinical trials.

Still, nudibranchs have hardly given up all their secrets. Scientists estimate that they’ve identified only half of all nudibranch species, and even the known ones are elusive. Most live no more than a year and then disappear without a trace, their boneless, shell-less bodies leaving no record of their brief, brilliant lives.

—Jennifer S. Holland, NG Staff

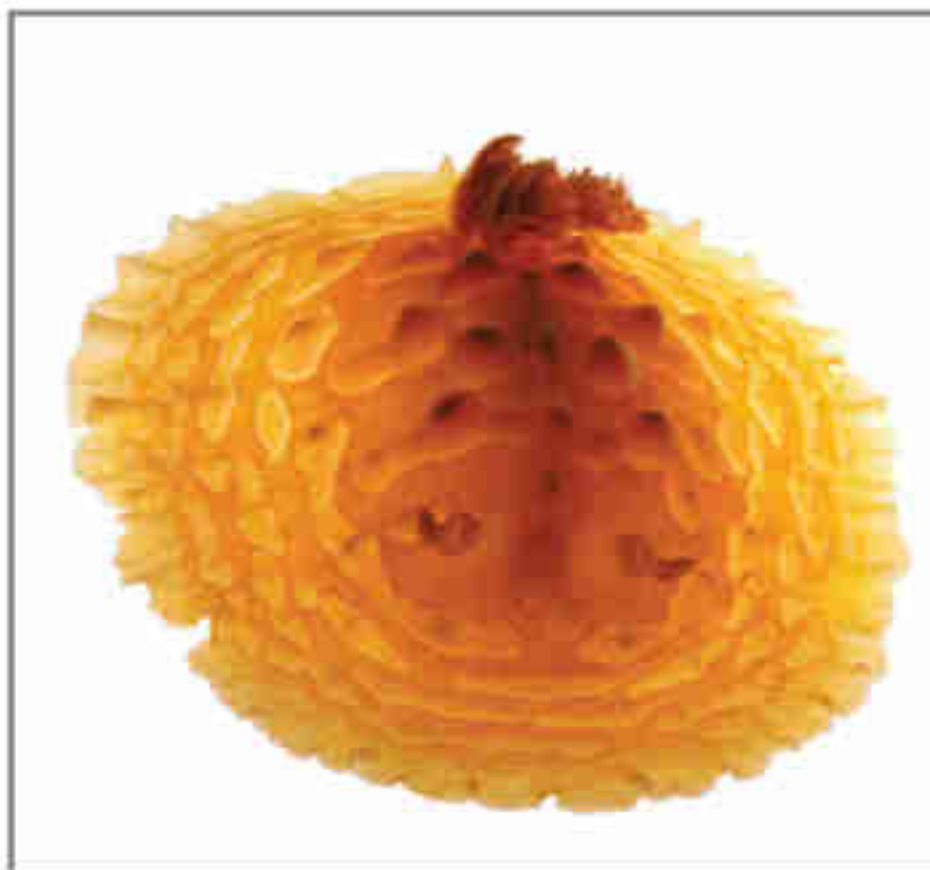
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*David Doubilet found these creatures in Indonesia, photographing them where they lay or on a white background before returning them unharmed. Learn more in Inside Geographic, page 152.*





*GLOSSODORIS AVERNI* • 2.4 IN (6 CM)



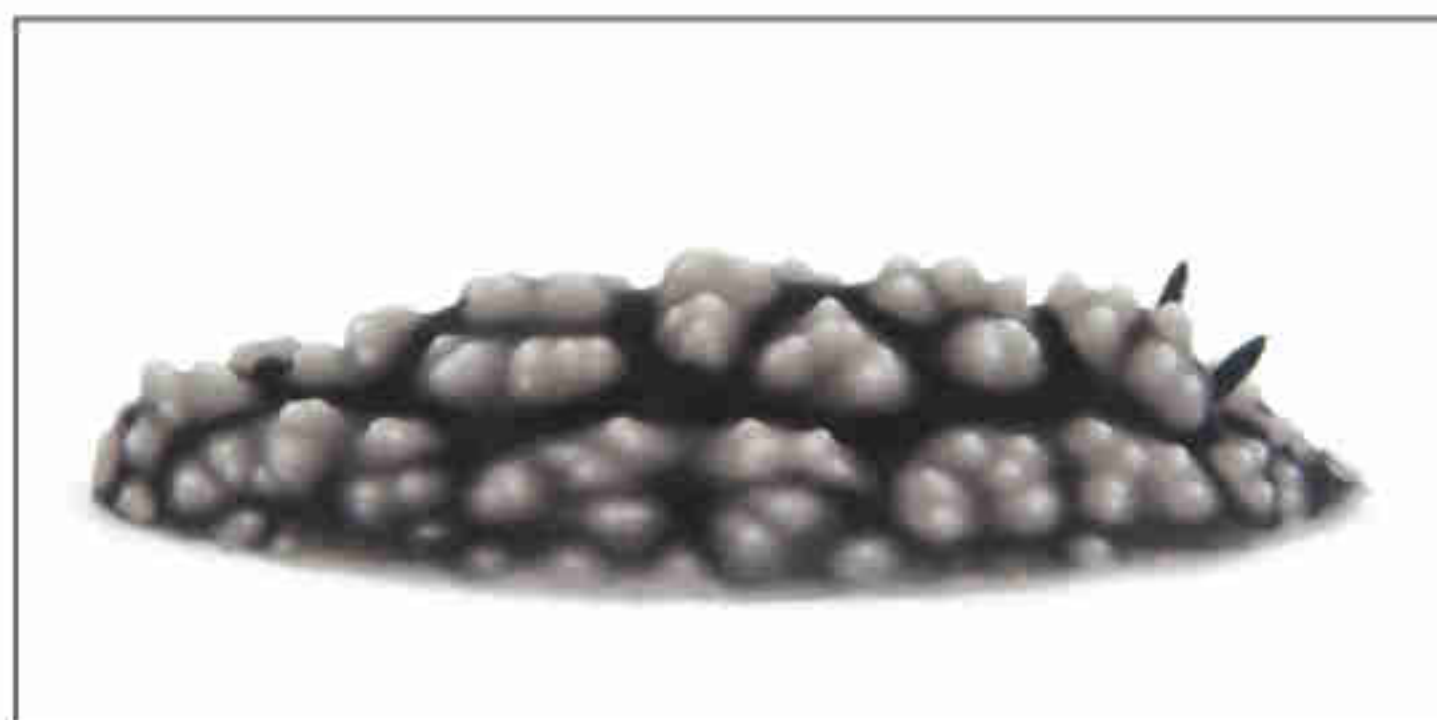
*ASTERONOTUS CESPITOSUS* • 8.7 IN (22 CM)



*FLABELLINA EXOPTATA* • 1.2 IN (3 CM)



*CUTHONA* SP. • 0.7 IN (1.8 CM)



*PHYLLIDIELLA PUSTULOSA* • 2.4 IN (6 CM)



*THECACERA PACIFICA* • 2.4 IN (6 CM)



*JORUNNA FUNEBRIS* • 2 IN (5 CM)



*PHYLLIDIA OCELLATA* • 2.4 IN (6 CM)



*HYPSELODORIS* SP. • 2 IN (5 CM)



*MEXICHRONIS MARIEI* • 1.2 IN (3 CM)



*CHROMODORIS DIANAE* • 2.4 IN (6 CM)



*PTERAEOLIDIA IANTHINA* • 5.9 IN (15 CM)



*NEMBROTHA CRISTATA* • 4.7 IN (12 CM)





*Chromodoris annae* compensate for their tiny size with loud, contrasting hues—warning predators of a toxic snack. 0.9 IN (2 CM)



CERATOSOMA GRACILLIMUM • 4.7 IN (12 CM)



CHROMODORIS GEOMETRICA • 1 IN (2.5 CM)



GODIVA SP. • 1.6 IN (4 CM)





**Breeding and Feeding** Inch-long *Hypselodoris whitei* (above) mate head to tail through a genital aperture. Equipped with both male and female reproductive organs—as are all nudibranchs—each fertilizes the other, and both produce eggs. *H. kanga* (right), 1.6 inches long, uses its sticky foot to secure an egg ribbon extruded from an oviduct on its side; hatchlings by the thousands will soon disperse with the currents. As adults, nudibranchs can be finicky eaters: A zebra-striped species of *Armina* (below), a genus that ranges to 8 inches long, plays tug-of-war with its sole prey, the burrowing sea pen. A tiny blenny bystander picks the safer perch.













A hard body and thick skin help armor *Halgerda batangas* against predators. Any that persist learn that the sponge-eater also exudes a toxin. 1.6 IN (4 CM)







**Beautiful Swimmer** With a flip of its skirt, *Hexabranhus sanguineus* can flee danger by taking to the open sea—a skill many of its cousins lack. Known as the Spanish dancer, the species is a giant among nudibranchs; some grow to a foot and a half, on a diet strictly of sponges. When not flashing its contrasting mantle colors to distract predators, the animal is actually camouflaged in its habitat. So are tiny imperial shrimp, *Periclimenes imperator*, which at 0.7 inch long can nestle in the dancer's gills (above), finding safe harbor and bits of food. Whether the tag-along shrimp benefit their host is uncertain—one of many nudibranch puzzles yet to be solved. □

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👉 **Spanish Dancer** See how this mesmerizing sea slug earned its name at [ngm.com](http://ngm.com).

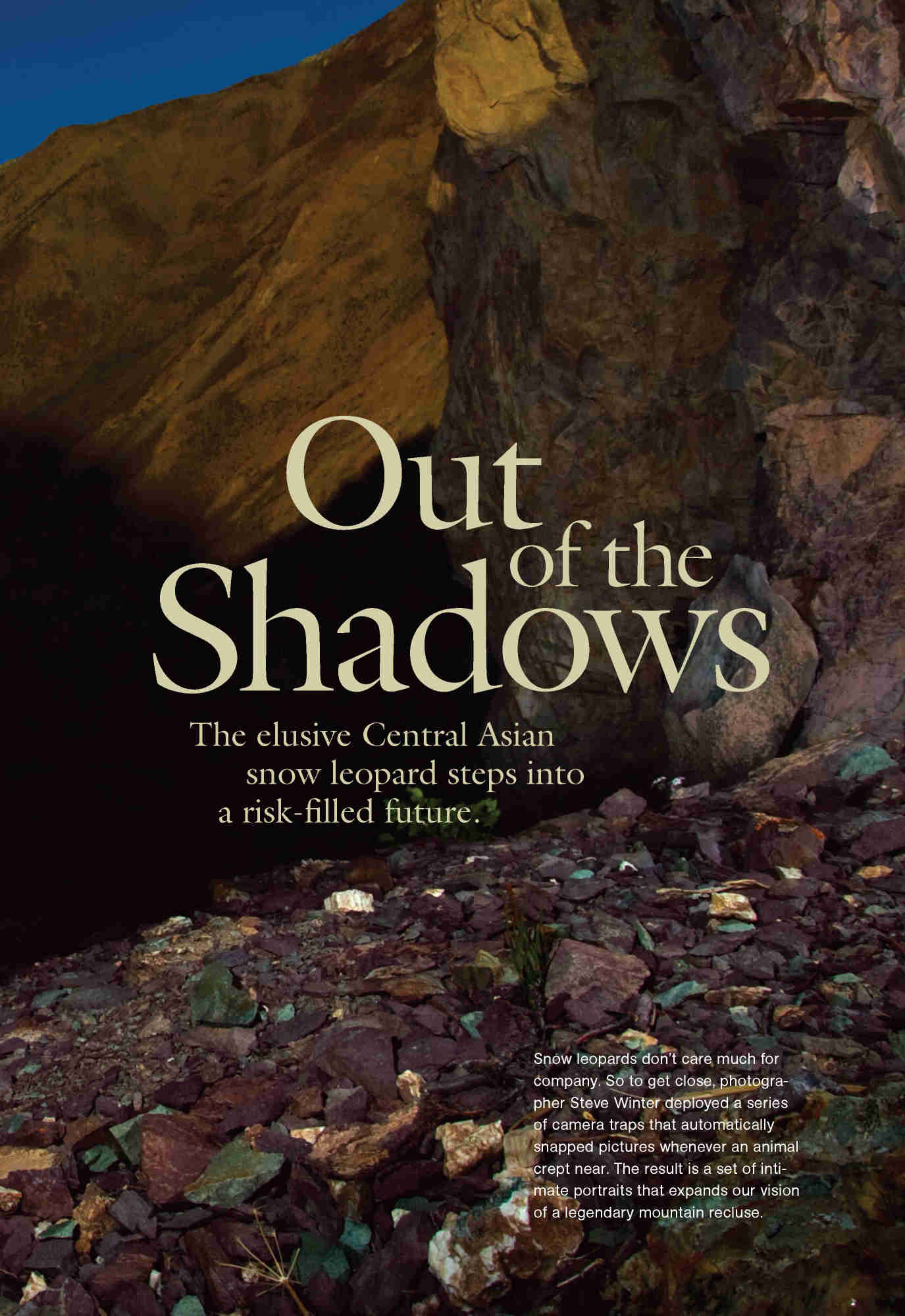












# Out of the Shadows

The elusive Central Asian  
snow leopard steps into  
a risk-filled future.

Snow leopards don't care much for company. So to get close, photographer Steve Winter deployed a series of camera traps that automatically snapped pictures whenever an animal crept near. The result is a set of intimate portraits that expands our vision of a legendary mountain recluse.



Rub, scratch, urinate, defecate—a snow leopard marks its trail with often pungent graffiti. The scent helps these solitary cats avoid confrontation in territory they share. During mating season, though, the scent is meant as a magnet. As few as 3,500 of these endangered cats may survive in the wild.











To traverse rocky slopes and survive in cold mountain climes—even at altitudes as high as 18,000 feet—snow leopards are well equipped. Long hair with thick underfur, wide, well-padded paws, and a big chest and strong lungs keep these cats running up where the air gets thin.







By Douglas H. Chadwick  
Photographs by Steve Winter

# When a snow leopard stalks prey among the mountain walls, it moves on broad paws with extra fur between the toes, softly, slowly, “like snow slipping off a ledge as it melts,” Raghu says.

“You almost have to turn away for a minute to tell the animal is going anywhere. If it knocks a stone loose, it will reach out a foot to stop it from falling and making noise.” One might be moving right now, perfectly silent and perfectly tensed, maybe close by. But where? That’s always the question. That, and how many are left to see?

Raghunandan Singh Chundawat has watched snow leopards as often as anyone alive. The New Delhi biologist studied them closely for five years in Hemis High Altitude National Park in Ladakh, the largest, loftiest district of northern India, and carried out wildlife surveys in the region over nine additional years. We’re in the 1,300-square-mile park this evening, setting up camp in a deeply cleft canyon near 12,000 feet. It’s June, and the blue sheep have new lambs.

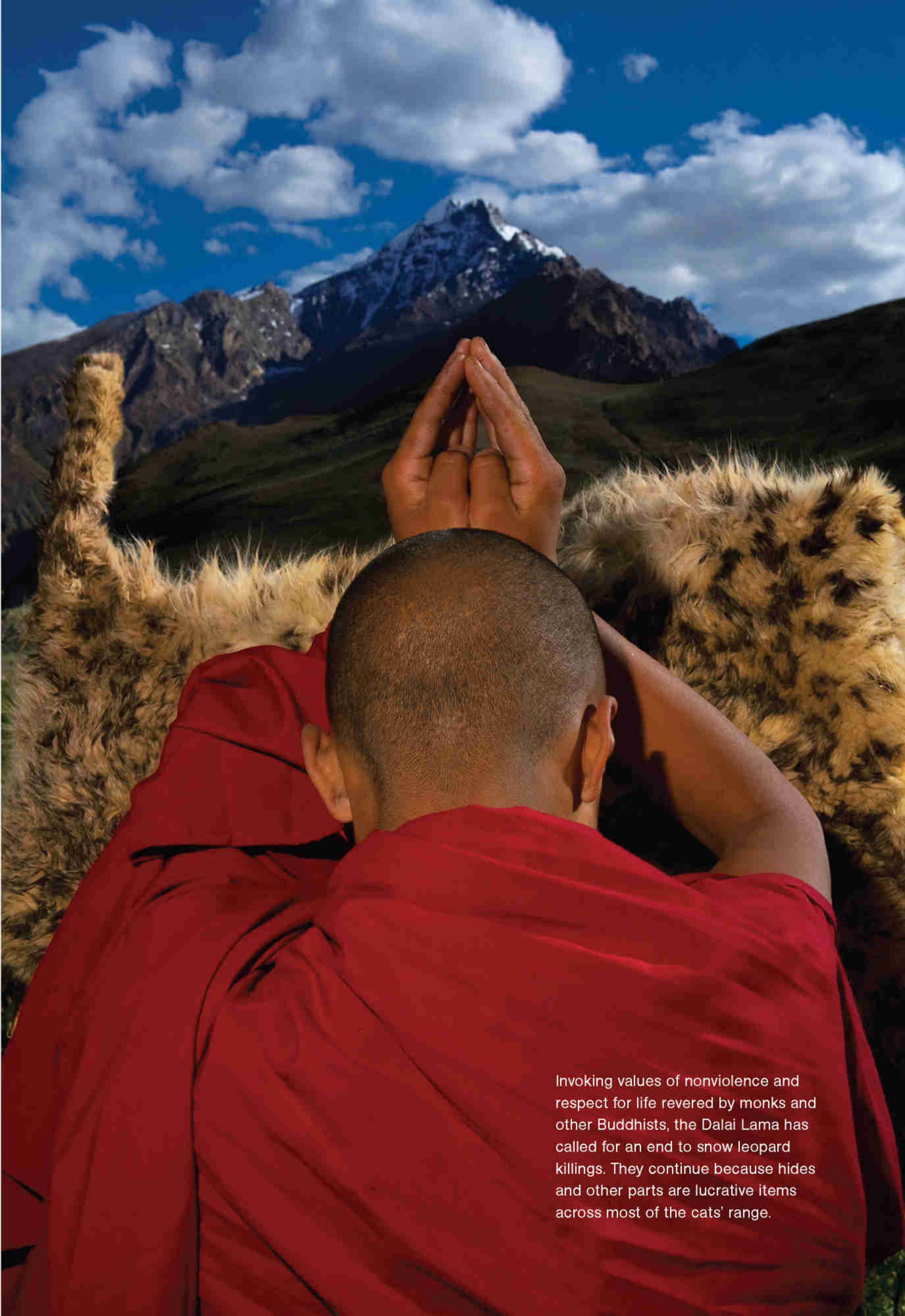
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*Steve Winter photographed Kamchatka’s bears for the February 2006 issue. Douglas Chadwick last wrote about Waterton Lakes and Glacier parks.*

We keep one eye on a group crossing a scree slope, the other eye on the cliffs at its top. Leopards are ambush hunters that like to attack from above. While the common leopard of Asia and Africa relies on branches and leaves for concealment, the snow leopard loses itself among steep jumbles of stone. This is exactly the kind of setting one would favor. But I’m not holding my breath. Raghu has sighted only a few dozen in his whole career.

Lengthening shadows coalesce into dusk. Wild roses perfume the Himalayan canyon as passing squalls brush the ridgetops with new snow. I imagine a leopard easing down the darkened slopes. It flows low to the ground, with huge gold eyes and a coat the color of dappled moonlight on frost. The body stretches four feet from nose to rump. Its tail, the most striking in the feline family, is almost as long, and so thick and mobile it looks as if the cat is being followed by a fuzzy python. The snow leopard sometimes uses its tail to send signals





Invoking values of nonviolence and respect for life revered by monks and other Buddhists, the Dalai Lama has called for an end to snow leopard killings. They continue because hides and other parts are lucrative items across most of the cats' range.



during social encounters or to wrap partway around itself like a scarf when bedded down in bitter weather. But the main function of this plume is to add balance in an environment with thousand-foot drops.

In Mongolia a park ranger once told me he'd seen snow leopards crouch and sway that plume in the air to lure curious marmots closer, just as hunters do with white rags. Possible. But I heard a simpler explanation from Sodnomdelg Bazarhuyag, a retired doctor in a community of herders in northwestern Mongolia. We went to search out snow leopard sign in a gorge glistening with river ice. When a band of scimitar-horned wild goats (ibex) appeared on the skyline, Bazarhuyag scanned carefully around them, saying, "Snow leopards are good at hiding, but sometimes they forget about their tail."

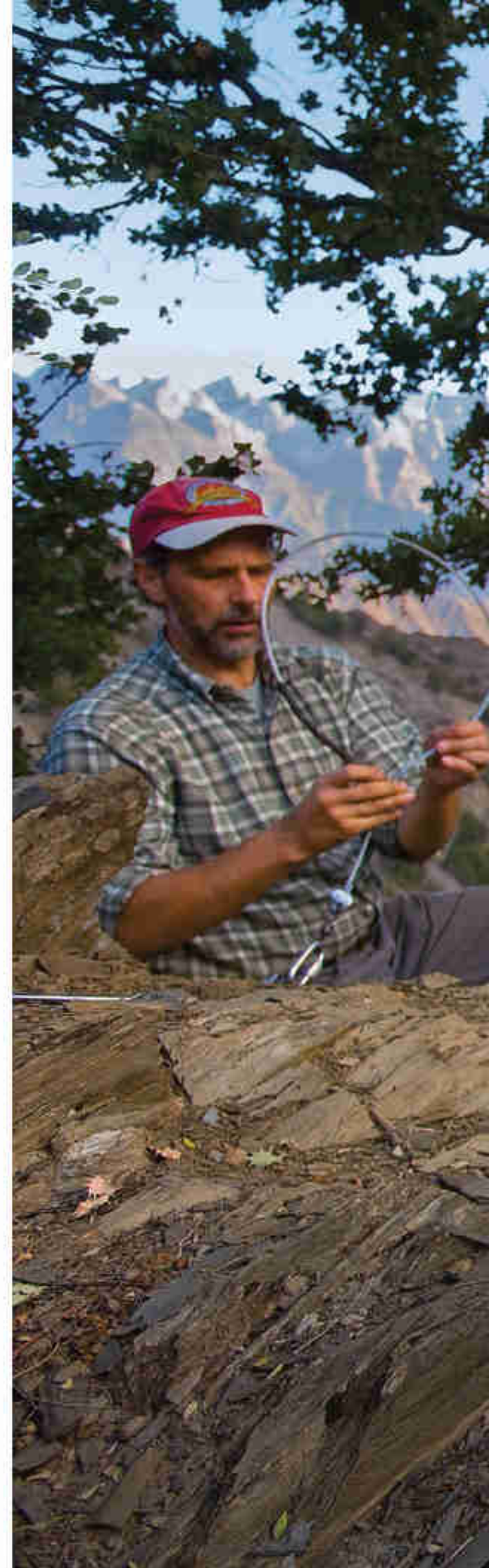
**DARKNESS CLAIMS** the last crags. Raghu and I won't glimpse a snow leopard this day. It's not a disappointment. The great cat is only living up to its reputation for being impossible to find. Called *shan* in Ladakhi, *irbis* in Mongolian, and *barfani chita*—snow cheetah—in Urdu, the carnivore scientists label *Uncia uncia* ranges across about a million square miles and portions of 12 nations. You'll never hear one give away its whereabouts by roaring; it lacks the throat structure, though it can hiss, chuff, mew, growl, and wail. Besides being secretive, well camouflaged, and usually solitary, snow leopards are most active at night and in the twilight hours of dusk and dawn, amid the most formidable tumult of mountains on Earth: the Himalaya and Karakoram; the Plateau of Tibet and adjoining Kunlun; the Hindu Kush, Pamirs, and Tian Shan; the Altay, whose peaks define Mongolia's border with China, Kazakhstan, and Russia; and the Sayan chain west of Lake Baikal.

Bound to high, cold, steep terrain, snow leopards have always remained at fairly low densities, but became still more sparse during the past century because thousands were turned into pelts for the fashion trade. Though officially protected since 1975 under the Convention on International Trade in Endangered Species, the spotted cats continue to be killed

On Pakistan's far northern frontier, a park ranger scans the slopes for wild goats—prime snow leopard prey—as researcher Tom McCarthy (left) sets up a snare beside a tree raked by cat claws. His goal is to capture and radio-collar a cat. "You can spend months in the mountains and not see a snow leopard or even any signs of one," says McCarthy. "But I can feel when they're around."

for their coat, worth a black market fortune. Demand for their bones and penis, hyped as tonics in eastern Asia, is increasing. Conflicts with livestock keep growing too, which leads to more persecution by herders. Bait, snares, pitfall traps, and poisons make it far easier to kill a snow leopard than to see one alive. The current population is estimated at only 4,000 to 7,000. While these aren't hard figures, the number may be less than half of what it was a century ago. Some authorities fear that the actual number may already have slipped below 3,500. Five of the countries in snow leopard range may have 200 or fewer.

There's no escaping the fact that most of the world's big cats are in deep trouble, from



■ **Society Grant** Camera-trap photography for this article was supported by an Expeditions Council grant made possible by your Society membership.





## A cat might be moving right now, perfectly silent and perfectly tensed, maybe close by.

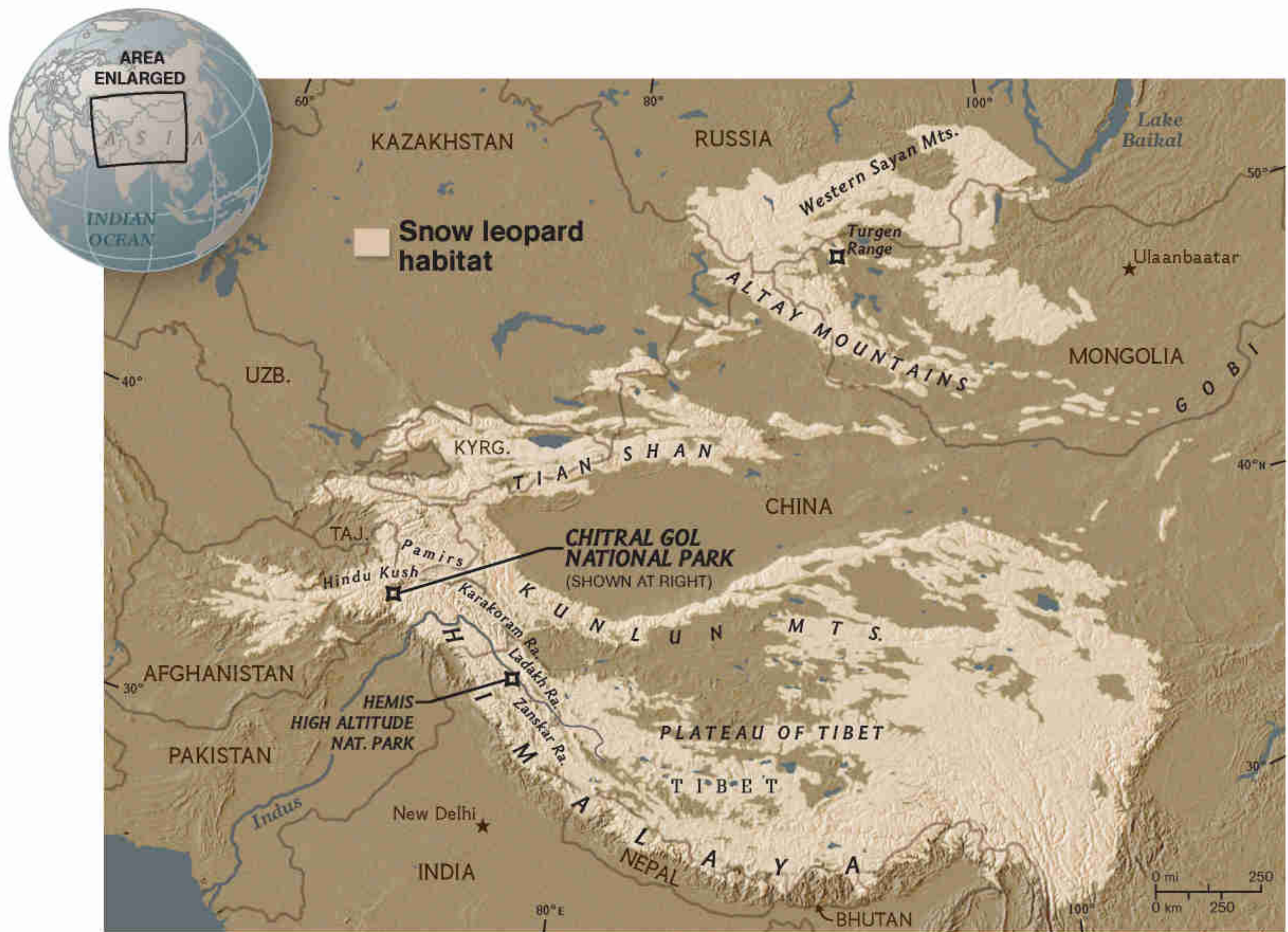
the heavily poached tiger to the last 30 free-roaming Amur leopards. Snow leopards are no exception. But here's some encouraging news: the rise of grassroots conservation efforts in a few locales to halt the snow leopard's downward spiral. Several community-based programs in India and Mongolia sounded especially promising—at least on paper. But how well do they really work?

Saving an animal means getting to know it, and scientific information about the leopard is scarce. Perhaps no other large, popular land mammal has so many details of its natural history still missing. Raghu, the regional director of science and conservation for the nonprofit Snow Leopard Trust, knows as much as anyone,

and he has that sixth sense that researchers with years afield develop, an extra awareness that guides him to the fragile leg bones of an infant blue sheep here in a ravine, or an ibex skull lying there, high on a slope where wind whips the wildflowers into blurs of color, and lets him say things like: “At a fresh carcass, you can tell if a snow leopard with young made the kill. The ears will be gnawed off. Those are all the cubs can get at until she opens up the hide for them.”

Tall and fit, with a long-legged stride, Raghu is a wizard at trailing faint paw prints across stony ground. But the otherwise ghostlike predators also leave behind a surprising amount of more obvious clues. It helps to picture 80- to 120-pound cats in a colossal litter box.





Terrain high enough and rugged enough to serve as potential habitat for snow leopards covers about a million square miles in 12 countries. Much of that range is severely fragmented, and scant resources are dedicated to its protection.

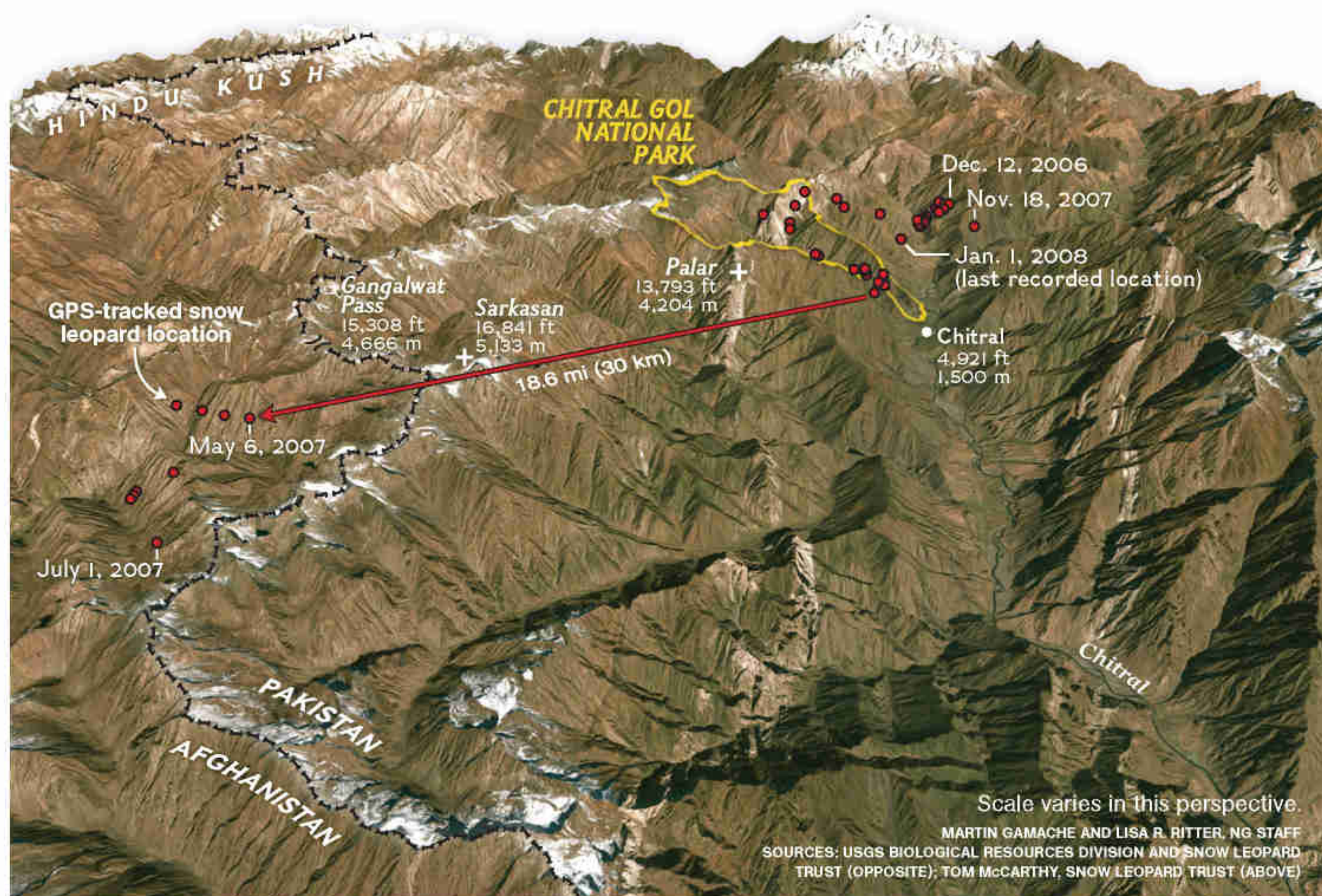
Droppings, together with scrapes made by the rear legs, reveal habitual routes that tend to follow ridgelines or the base of cliffs. Scrambling for footing day after day, I gradually realize that these travelers like to mark the same type of features that draw my attention en route: solitary boulders, sharp corners along gullies, knolls, and saddles. Near tree line, they stripe the occasional trunk with long, vertical claw marks.

If my eyes are too busy taking in scenery to notice a fresh scrape, my nose will still register the acrid tang of leopard pee. Elsewhere, I'll catch a musky aroma sprayed from anal glands up onto an overhanging rock. Frequently used scent posts take on an oily sheen. Passing cats stretch to rub their cheeks against them, leaving white hairs for me to tuck in a pocket for luck scaling the next rock face. Fifteen, sixteen thousand feet, no matter how far up I climb, some villager will have gone higher and left stone cairns bearing prayer flags or stacks of horns. Later, the cats come by and leave their own markings on these offerings. "A lot of

research on snow leopard movements really tells you more about the limits of human abilities," says Raghu after crossing a cascade swollen with glacial melt. "You can only climb so many slopes before you grow exhausted or encounter sheer cliffs. It is just not possible to keep up." So Raghu tried capturing the cats to attach radios to them. He finally collared a female. But, like previous investigators, he was seldom able to monitor a signal for long before the animal dropped behind some ridge that blocked the transmission.

Over the years, biologists reported snow leopards covering territories of five to fourteen square miles. But when American biologist Tom McCarthy first placed a satellite collar on one in Mongolia in 1996, he found it roaming 386 square miles. "My guess is that the more satellite collars we get out, the larger we'll discover snow leopard territories to actually be," said McCarthy, now the science and conservation director of Snow Leopard Trust. Ten years passed before the next satellite tag was put on, again by McCarthy, this time in Pakistan. By mid-2007





Red dots mark the meanderings of one satellite-tracked leopard as it loped between Pakistan and Afghanistan. The tracking collar was meant to send data regularly, but a technical glitch blocked transmissions for several months.

the cat wearing it had revealed its movements over a 115-square-mile area and had moved across the border to Afghanistan.

**SNOW LEOPARD RESEARCHERS** need to gather more than cat facts, because you can neither understand nor save a predator without doing the same for its prey. Snow leopards hunt chiefly Asia's high-country array of hoofed wildlife: ibex, argali and urial sheep, blue sheep, tahr, the goat-antelopes known as gorals and serows, Tibetan antelope, Tibetan and goitered gazelles, musk deer, red deer, wild boars, wild asses, wild yaks, and wild Bactrian camels. Marmots, hares, and mouse hares (pikas) are on the menu too, along with partridges and turkey-size snow cocks. On top of everything else, snow leopards routinely add the tall, feathery shrub *Myricaria* and other plants to their diet. Curious, but then my house cat swallows grass and loves cantaloupe.

As the top carnivore of the alpine and subalpine zones, the snow leopard strongly

influences the numbers and whereabouts of hoofed herds over time. That in turn affects plant communities and thus shapes the niches of many a smaller organism down the food chain. The leopard's presence—or absence—affects competing hunters and scavengers too, namely wolves, wild dogs, jackals, foxes, bears, and lynx. This cascade of consequences makes *Uncia uncia* a governing force in the ecosystem, what scientists term a keystone species.

Since the range of the snow leopard overlaps those of so many other creatures, protecting its habitat also preserves homes for the majority of mountain flora and fauna. While we were exploring part of the Zaskar Range in Ladakh, Raghu and I crossed tracks that sent him racing off to an overlook. A few minutes later, a brown bear—the same species as North America's grizzly—galloped and slid down a high riverbank, swam across surging rapids, muscled halfway up a cliff wall, and finally lay down to dry its silver-tipped fur in the warm morning sun. We had found one of the last few dozen









Crags and crevices in India's Hemis National Park give snow leopards cover when they are hunting, but offer less effective protection from poachers. Wildlife conservationist George Schaller fears the cats might someday only survive in zoos—a fate he calls “a sad compromise.”



of its kind in that huge section of the Himalaya.

Do snow leopards attack humans, as bears sometimes do? No, never, Raghu says. He once watched a village girl pulling on one end of a dead goat, unaware that the other end, hidden by a bush, was snagged in a snow leopard's jaws. She came away unscratched. But a single leopard swatfest in a herd of livestock can plunge a family into desperate poverty.

Because farming is marginal at best in Central Asia's cold, dry landscapes, traditional cultures depend mainly upon livestock to get by. Some herders operate from mountainside hamlets. Others are nomadic, migrating long distances between seasonal pastures. Either way, snow leopard conflicts come with the lifestyle. Wired to select the unwary and the stragglers among wild ungulates, the cats can hardly help picking off a few domesticated versions. At night, when flocks are stuffed into low stone corrals, a leopard can all too easily hop in to join them.

During a several-day trek through the Sham area of the Ladakh Range, which rises to the north of the Zaskar Range, on the other side of the Indus River Valley, Jigmet Dadul, a conservationist, and I made our way over the passes to the barley fields and poplar groves of the village of Ang. There we looked up Sonam Namgil. Three

## When Namgil opened the door, he found wide golden eyes staring back.

nights before, a snow leopard had leaped atop his stout mud-brick outbuilding and then ten feet down through a ventilation hole onto the floor. When Namgil opened the door in the morning, he found wide golden eyes staring back amid the bodies of nine goat kids and a sheep.

"The wolf comes and kills, eats, and goes somewhere else," said the 64-year-old herder in a ragged sheepskin coat, "but snow leopards are always around. They have killed one or two animals in the pastures many times. This was the first problem at my home. Everybody wanted to finish this leopard."

The cats may claim only a small part of livestock herds, but the loss may be huge to the owner. Where losses mount, it's often because human hunting has made natural prey scarce.

Overgrazing by livestock also reduces the natural capacity of rangelands to support native herds. Hungry leopards turn to the tame flocks for food, and angry herders kill the cats in retaliation. With little or no government enforcement of wildlife regulations in remote areas, a protection strategy has little chance of breaking these cycles unless it gains local support.

Religious leaders have recently spoken up on the leopards' behalf. Within the mountain-ringed courtyard of the Rangdum monastery, between the Zaskar Range and the main Himalaya, Tsering Tundup, a Buddhist monk, said, "Whenever we have an opportunity, we talk to people and encourage them not to kill any being." Several people told me that the villagers listened when a lama farther up the valley condemned a spate of revenge shootings of snow leopards. Soon afterward, a new lotus-shaped shrine was built with the herders' guns cemented inside.

The Dalai Lama, leader of Tibetan Buddhism, who is widely followed in Central Asia, has specifically urged followers to safeguard snow leopards and avoid wearing their pelts as part of traditional festive clothing. "People depend upon animals, but we must not use them for our luxury," he told me during an interview in

Washington. "Wild animals are the ornaments of our planet and have every right to exist peacefully. Some, including snow leopards, are quite rare and visible only at high

altitudes. So we need to pay special attention to protect them."

Financial incentives can also make a difference. Jigmet Dadul's employer, Snow Leopard Conservancy-India, had helped set up Himalayan Homestays, a program that steers trekkers to the houses of herders who agree to protect snow leopards and their wild neighbors. For a clean room and bed, meals with the family, and a warm introduction to their culture, visitors pay about ten dollars a night and save carrying a tent and food. Having guests once every couple weeks through the tourist season provides the hosts with more than enough income to replace stock lost to predators.

The conservancy donates funds to cover livestock pens with stout wire mesh. Rodney



Their big eyes are so well adapted for low-light vision that snow leopards can hunt in near total darkness—but they can still go hungry when humans compete for their prey. Though trophy hunts for wild sheep and goats bring income to local communities, they can deplete food stocks for snow leopards.





That tail—fluffy as a muffler and almost body length—helps a snow leopard stay warm and keep its balance on hazardous ledges. These predators also help keep mountain ecosystems in balance by reducing the numbers of wild sheep and goats that otherwise might overgraze alpine grasslands.











## A single leopard swatfest in a herd of livestock can plunge a family into desperate poverty.

Jackson, the pioneering snow leopard researcher who founded the conservancy, says, “We figure each project to predator-proof the corrals of a village this way saves an average of five leopards.” The organization also launches small-scale livestock insurance programs and provides seed money for parachute cafés—trailside tea shops beneath an army surplus parachute pitched like a big tent. Meanwhile, teams conduct environmental classes at village schools and train Homestays members as nature guides, available for hire. Homestays families pool 10 percent of their profits for community projects that conserve cultural values, such as renovating a monastery, or improve habitat for wildlife.

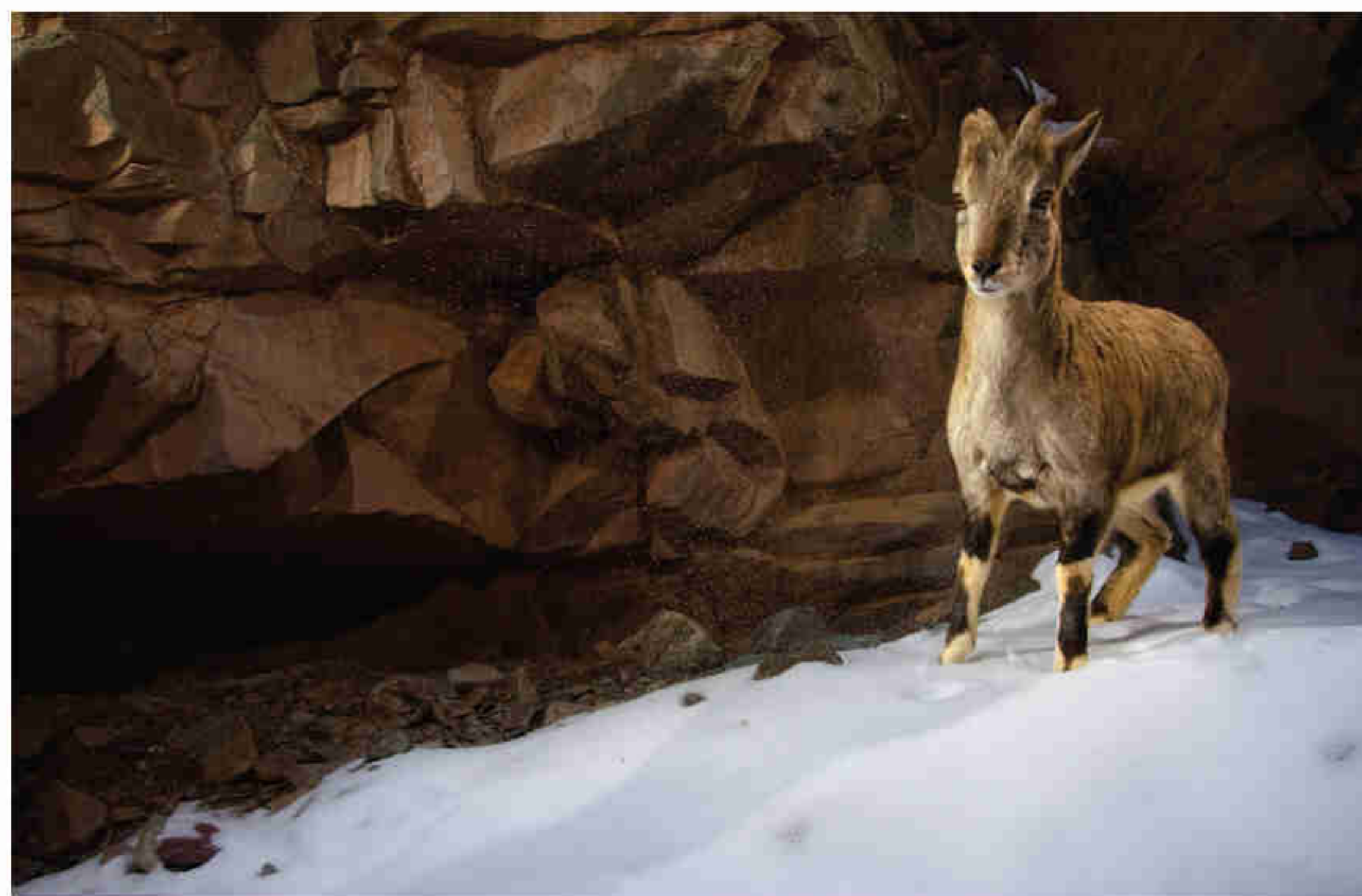
In case you’re wondering what happened to

the marauding cat that was stuck inside the tall building in the village of Ang, the news that brought villagers crowding in for a peek also reached the ears of a local Homestays nature guide. By insisting that they let authorities relocate the animal, the young man saved a snow leopard from being beaten to death.

“That is the kind of story that keeps you going,” says Rinchen Wangchuck, who helped conceive Homestays.

Snow leopard numbers for Hemis National Park and other strongholds in Ladakh look stable or even on an upward trend. Blue sheep are definitely increasing, and urial sheep have made a strong comeback from lows caused by poaching. Regional wildlife departments,





Stanzin Pulit's yaks (left) are his wealth, and in Ladakh's Zaskar Valley, herds are vulnerable to snow leopard attacks. Conservation groups help herders build protective corrals in return for their pledge not to kill snow leopards. Such aid gives locals economic incentive to preserve the predators—good news for the region's ecotourism initiatives, but mixed news for prey like blue sheep (above).

nonprofit groups, and the mountain villages can all claim the credit together.

Success stories like these are rare in other parts of snow leopard range, where the cats continue to vanish from many locales like snow patches under a summer sun. Sprawling China hosts the greatest share—perhaps 2,000, mostly spread across the wrinkled immensity of Tibet. Yet authorities worry that the cats are being heavily hunted in China, the world's largest market for illegal tiger and leopard products. To undermine the Dalai Lama's influence, officials have even forced some Tibetans to wear snow leopard fur. Due to recent heavy poaching in Kyrgyzstan, the next-largest population of the predators may now belong to

Mongolia, which probably holds 800 to 1,700.

Mongolia remains almost as much a nation of herders as it was during the era of Genghis Khan. Livestock outnumbers the 2.6 million humans fifteen to one. Though an admirable network of parks and reserves has been established in western Mongolia, the infrastructure to manage them is thin.

"We don't have enough staff to protect their core wildlands from heavy livestock grazing, poaching, forest fires, and illegal woodcutting," explained Mantai Khavalkhan, the superintendent of four reserves in Mongolia's Altay region. Yet the cat Khavalkhan called "the most secret of animals" appears to be holding its own where conservation efforts have won local support.

One winter Dashdavaa Khulaa, a park ranger in the Turgen Range, watched a herd of 27 ibex take shelter in a cliff-face cave. A mother snow leopard with two partly grown cubs followed them in. Only 24 ibex made it out. For Khulaa, the tale is part of a larger story: Though the Turgen Range, part of the Altay Mountains, saw some heavy wildlife poaching in the past, it has become a stronghold for ibex and their predators. One of the reasons is a grassroots antipoaching patrol in the Altay region known as the Snow Leopard Brigade. Ganbold Bataar, former director of Mongolia's national park system here in the province ofUvs, is its founder and current chief.

"With two employees for this whole province, we couldn't hope to keep up," Bataar said. "But we have more than 290 volunteers here." They







In fields below the cliffside monastery of Phuktal, Indian farmers harvest barley one fistful at a time. As more people try to eke out a living on higher ground in the Himalaya, they increasingly cross paths with snow leopards traveling down the mountains during winter in pursuit of food, wild or domesticated.





were local herders, and their eyes were everywhere in the countryside. Whoever turned in a poacher stood to gain 15 percent of the fine as a reward. But that wasn't always the main incentive. Toward evening, three horsemen driving their flocks home galloped over to visit our camp. They all considered themselves volunteer members of the antipoaching brigade. They knew the mother snow leopard well. She'd had three new cubs the previous year, they said. The two from her earlier litter had gone off to establish territories of their own on the mountain slopes just across the river. One had appeared prowling the iron-red ledges there just recently. One of the horsemen said simply, "I'm proud to live in a place with snow leopards."

A small, soft-spoken woman named Bayarjargal Agvaantseren has found another way to enlist local communities in conservation. Twice every year, this former schoolteacher sets out from the Mongolian capital, Ulaanbaatar, to visit some of the 24 herder communities she has engaged in a handicrafts project tagged Snow Leopard Enterprises (SLE), a program of the Snow Leopard Trust.

Most herder families used to sell the soft underfur of goats—cashmere—to middlemen, earning about \$600 a year. Thanks to Agvaantseren, women in the community now also make an array of products using wool from their goats, sheep, yaks, and camels: skeins of soft yarn, felt and decorative rugs, seat pads, children's booties, or Christmas tree ornaments shaped like snow leopards and ibex. My favorites were doll mice with whiskers of stiff yak tail hair—toys for little cats, designed to save big ones.

Through Agvaantseren, the organization buys these items from herding families and arranges to market them abroad. Participants must first sign a pledge to preserve snow leopards and their prey and to encourage neighbors to do the same. The arrangement boosts incomes by 10 to 15 percent, which elevates the status of the women and translates into more emphasis on education and health care. If no one in the community kills protected species over the course of a year, the program members receive a 20 percent bonus.

In one of Agvaantseren's communities, a winter village of herders in far northwestern Mongolia, a lively scene of trade took place on the floor of a *ger* heated by a stove fueled with yak dung.

Long, muscular hind legs enable snow leopards to leap seven times their own body length, but such prowess hasn't kept them out of harm's way. The cats will flourish, say conservationists, only when they become more valuable alive than dead.

Tangible paybacks give local people a chance to embrace their deepest spiritual values—and their respect for life—without risking their own survival.

A Khazakh woman named Saulekhan Kekei had brought 17 felt rugs made over 68 days. She had six children and an ill husband to support. Those rugs would bring the equivalent of nearly three months' wages in her job as a janitor and guard at the village school. "I own only 12 sheep," Saulekhan said. "I have to buy wool from neighbors. But I am able to provide for everyone at home now and pay for my eldest daughter to go to college."

An independent review in 2006 found no poaching of snow leopards in areas where SLE operates. Agvaantseren just added eight more communities and intends to expand a micro-credit scheme that lets members borrow at a discount to buy items such as spinning wheels







The tail is so thick and mobile it looks as if the cat is being followed by a fuzzy python.

or material to improve corrals. “People hear good reports from neighbors, and they come to us now asking how to join,” she said.

In our imagination, snow leopards belong to a realm beyond the dust and noise of human affairs. In reality, only about a fifth of their range lies within reserves, and many of these contain villages and livestock. Informal protected zones exist around many Buddhist monasteries, but the Western model of establishing nature sanctuaries in landscapes unoccupied by humans simply doesn’t fit much of Asia.

Projects like the Homestays program in India and the handicrafts business in Mongolia, however, seem to fit very well. Though they cover only a small fraction of the species’ homeland

so far, they make live leopards more valuable to more people each year, and in doing so they mark a path toward the conservation of high mountain ecosystems.

I never minded not seeing snow leopards—not as long as I found plenty of their sign. It was my guarantee that I would soon come across other spectacular wildlife. And it meant that I could still dream of pulling myself up to the spine of a ridge, as Raghu once did, and meeting face-to-face with a snow-cloud-colored cat climbing from the other side. □

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🐾 **What’s it like** chasing snow leopards in some of Asia’s wildest mountains? Watch a behind-the-scenes video about photographer Steve Winter at [ngm.com](http://ngm.com).







# Afghanistan's *Hidden* Treasures



By ROGER ATWOOD

Photographs by RICHARD BARNES

Concealed from invading Soviets, later from the Taliban, and feared lost, a trove of precious antiquities reveals the rich cultures that came together at one of history's great crossroads. For a country shattered by decades of war, evidence of a glorious past inspires a renewed sense of national pride.

ALL ARTIFACTS SHOWN BELONG TO THE NATIONAL MUSEUM OF AFGHANISTAN, KABUL.  
LEFT: GOLD PENDANT FROM TILLYA TEPE, 4.9 INCHES (12.5 CENTIMETERS) TALL  
ABOVE: CARVED IVORY FROM BEGRAM, 11.8 IN (30 CM) LONG. BOTH FIRST CENTURY A.D.





A gilded silver plate from the Greek colony of Ai Khanum unites classical deities and local designs. Watched by the Greek sun god Helios in his crown of rays, Cybele and Nike ride in a Central Asia-style chariot pulled by lions. The plate's creation followed Alexander the Great's fourth-century B.C. march into Asia.

SILVER AND GOLD-LEAF CEREMONIAL PLATE, 9.8 IN (25 CM) ACROSS, THIRD CENTURY B.C.





A sinuous sculpture in ivory resembles Ganga, India's river goddess. Hundreds of such ornate carvings in tusk and bone were found at Begram, along with Chinese lacquer, Egyptian glass, and other exotic goods that establish Afghanistan as a vibrant commercial center in the ancient world.

IVORY FIGURINE, 17.9 IN (45.6 CM) TALL, FIRST CENTURY A.D.





Officials from Kabul guard a crate of artifacts exhibited in Paris, Turin, and Amsterdam before heading to U.S. museums. "These are national treasures," says curator Fredrik Hiebert. "They're not going anywhere without the Afghans." The collection includes a miniature mask of a Greek god (top right).





## Omara Khan Massoudi knows how to keep a secret.

Massoudi is director of the National Museum of Afghanistan in Kabul. Like the French citizens during World War II who hid works of art in the countryside to prevent them from falling into Nazi hands, Massoudi and a few trusted *tahilwidars*—key holders—secretly packed away Afghanistan’s ancient

treasures when they saw their country descend into an earthly hell.

First came the Soviet invasion in 1979, followed about ten years later by a furious civil war that reduced much of Kabul to ruins. As Afghan warlords battled for control of the city, fighters pillaged the national museum, selling the choicest artifacts on the black market and using museum records to kindle campfires. In 1994 the building was shelled, destroying its roof and top floor. The final assault came in 2001, when teams of hammer-wielding Taliban zealots came to smash works of art they deemed idolatrous. When they finished, more than 2,000 artifacts lay in smithereens.

Throughout those dark years, Massoudi and a handful of other museum officials kept quiet about the hoard of museum artifacts—among them the crown jewels of Afghanistan, the famed Bactrian gold—that they had hidden in vaults under the presidential palace in 1988, as the Soviet occupation gave way to civil war. Researchers the world over despaired of ever seeing the objects again, thinking they’d been sold piecemeal into the illicit antiquities trade or destroyed by the Taliban in their final, iconoclastic frenzy.

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*Roger Atwood is the author of Stealing History, an investigation of the antiquities trade. Richard Barnes’s latest project looks at the role of museums in society.*

By October 2003—more than two years after U.S.-led forces toppled the Taliban regime—most of the key holders had disappeared or had fled Afghanistan. Massoudi felt it was time to see if the objects had survived the war. When a team of locksmiths wrenched open the safes that month, every last piece of the Bactrian gold was there, trussed in the same tissue paper in which the museum staff had wrapped it. Five months later, researchers opened a set of footlockers stashed in the same underground vault and made another jaw-dropping discovery: priceless 2,000-year-old ivory carvings and glassware that had been excavated in the 1930s from a site known as Begram and given up for lost. Massoudi’s staff had cloistered those away too, and they were remarkably well preserved.

“If we had not hidden them, the treasures of Afghanistan would have been lost. That is a fact. Those who knew the truth kept silent,” says Massoudi, sipping ginger tea in his spartanly furnished office. His museum—Afghanistan’s museum—has been rebuilt with help from UNESCO and other international donors, and it hums with activity now. Exhibit planners stroll from gallery to gallery, taking measurements for future installations; teachers lecture in Dari to groups of schoolgirls in head scarves. At the door, policemen in gray-flannel uniforms keep a close watch. Visitor numbers have inched up to about 6,000 a year. Storerooms are filling with



“If we had not hidden them, the treasures of Afghanistan would have been lost. That is a fact. Those who knew the truth kept silent.”

—Omara Khan Massoudi

DIRECTOR, NATIONAL MUSEUM OF AFGHANISTAN

looted artifacts intercepted by customs agents around the world and restituted to Afghanistan, including some 5,000 confiscated artifacts returned from Switzerland and Denmark. More than four tons of loot seized by British police sit in a warehouse in London's Heathrow Airport awaiting repatriation.

In the museum lobby, Massoudi demonstrates what it means to rebuild heritage. Standing in a display case is a life-size statue of a bodhisattva, a type of Buddhist deity, dating from the third century A.D., an era when Afghanistan was a predominantly Buddhist land. Taliban hammers had shattered the fired-clay statue, and museum conservators recently finished reassembling the fragments. A jigsaw of cracks is still visible, but the statue's face again glows with rapturous piety.

“As we finish the restoration of pieces, we bring them out to show the public, one by one. We will be doing this for many years,” says Massoudi. Yet the choicest artifacts—the ones he and his staff concealed for so long—won't be on display in Kabul for some time to come. The museum lacks an adequate security system and remains short on staff, while a series of suicide bombings around Kabul have underlined the continuing risks.

Faced with these problems, Afghans have gathered their ancient treasures into a dazzling exhibition and sent it on an international tour. The Afghan government asked National Geographic to inventory the artifacts and help organize the exhibition, which is currently at the National Gallery of Art in Washington, D.C., after a two-year spell in Europe. In addition to

safeguarding the treasures, the Afghans hope the exhibit will elevate the image of their country.

“The history of Afghanistan is one of receiving the arts of others, and then turning them into our own way of expression,” says Massoudi. He believes the exhibit will help people see beyond his country's recent history of intolerance and isolation to the open, cosmopolitan spirit that long characterized this creative melting pot and hub of the Silk Road trade.

Walk through the bazaars in Kabul or Mazar-e Sharif and you'll see why, for more than two millennia, people have been calling Afghanistan the crossroads of Asia. One face looks Mediterranean, another Arab—or Indian, or Chinese, or eastern European. Eyes range from pea green to chestnut brown to something approaching orange. Successive invasions and influences wove a tapestry of ethnicities and left behind what the exhibition curator, Fredrik Hiebert of the National Geographic Society, calls “some of the most remarkable archaeological finds in all of Central Asia.”

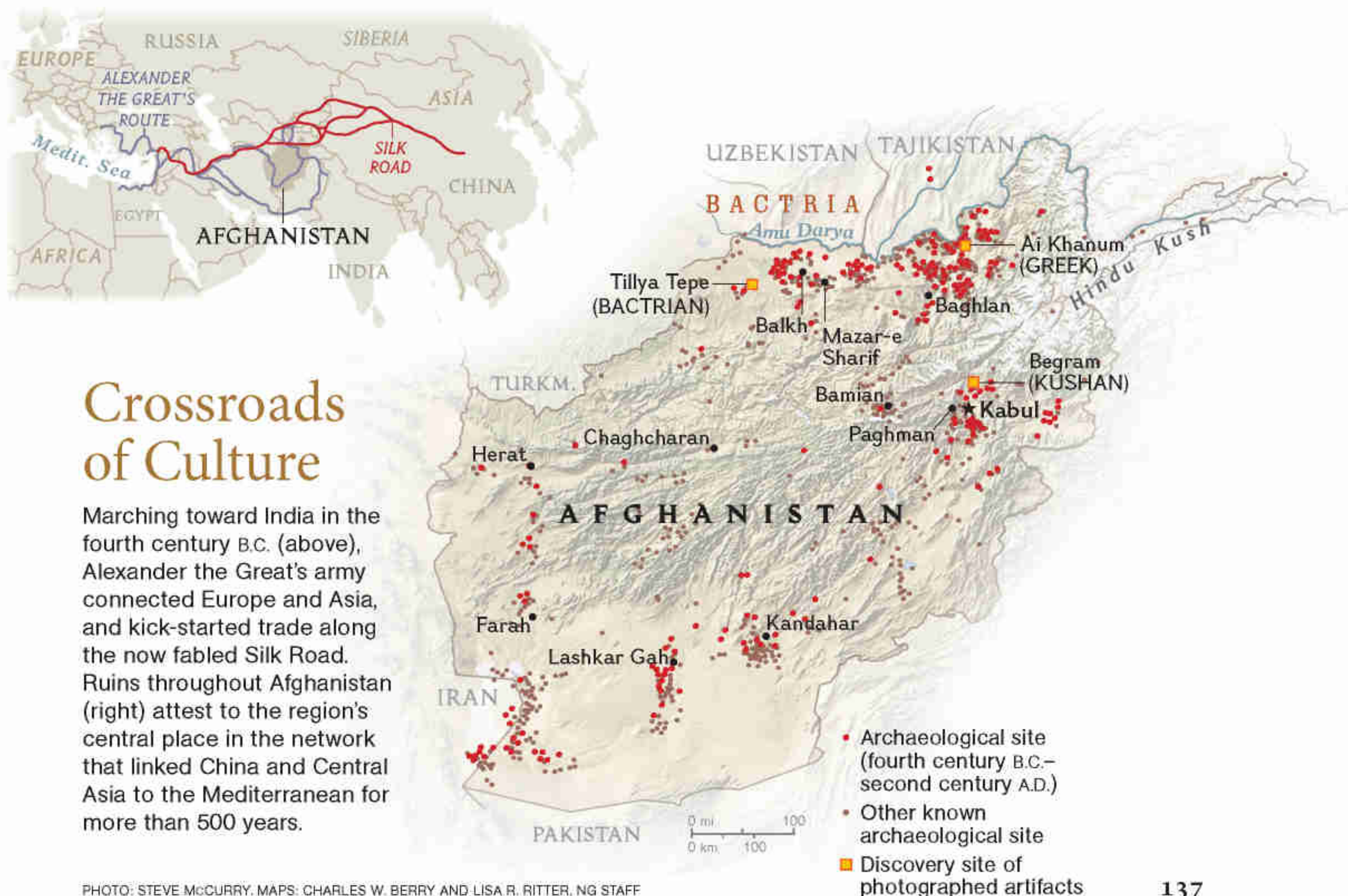
THE ANCIENT CITY of Begram supplied many of the luminous objects. Today Soviet-era land mines litter its grassy landscape, and American fighter jets from a nearby air base howl overhead. But 2,000 years ago this was the opulent summer capital of the great Kushan Empire, which stretched as far as northern India. Traders brought ivories and art from all corners of Asia. Courtiers stuffed themselves on local figs, pomegranates, and grapes against the majestic scrim of the snowy Hindu Kush.

When French archaeologists cut into the site in the late 1930s, they found a cache of luxury goods suggesting a vibrant, trade-based economy that flourished while Rome crumbled. Buried under layers of soil were bronze sculptures from Italy, lacquer boxes from China, plaster medallions of muscular Greek youths, and a group of exquisitely painted Egyptian glass vessels depicting, among other things, the Alexandria lighthouse, an African leopard hunt, and a scene from the *Iliad*. Most strikingly, the diggers found stacks upon stacks of carved





Where trading communities once prospered, researchers know much remains to be discovered—and thieves do too. Nadir Rassouli, director of the Afghan Institute of Archaeology, inspects a looter's hole near Paghman with some of the 500 national police recently assigned to protect more than 1,500 ancient sites.











Foreign luxuries passed through Afghanistan on their way to other places, while local artists produced coveted things of beauty as well. The handle of a dagger (left) from a nomad's burial at Tillya Tepe—with imaginary beasts on the shaft and a Siberian bear at the top—was likely made from native gold and turquoise. A plaster medallion of a youth, viewed here through an exhibit window, was uncovered at Begram along with other Greek-style figures. All may have been used to demonstrate what a craftsman could create in metal.

LEFT: DAGGER WITH IRON BLADE, GOLD HANDLE SET WITH TURQUOISE, 14.8 IN (37.5 CM) LONG  
ABOVE: PLASTER RELIEF, 8.8 IN (22.3 CM) ACROSS, BOTH FIRST CENTURY A.D.





LIMESTONE FOUNTAIN SPOUT, 8.3 IN (21 CM) TALL, SECOND CENTURY B.C.



ABOVE: FISH-SHAPED GLASS VESSEL, 7.9 IN (20 CM) LONG. RIGHT: GOLD ROBE ORNAMENT SET WITH TURQUOISE, GARNET, AND PYRITE, 11.5 IN (29.1 CM) LONG. BOTH FIRST CENTURY A.D.

Diverse artifacts offer glimpses into life in antiquity. A gold collar inlaid with gems (right) was sewn to the robe of a noblewoman buried at Tillya Tepe. She and her fellow nomads probably wore their finery wherever they went. A stone gargoyle from Ai Khanum (top left) spouted water at a fountain where people may have bathed after visiting a nearby gymnasium. A glass flask in the shape of a fish (left) survived a long journey to Begram from Egypt, then lay buried for centuries in the ruins of what experts now believe was a merchant's warehouse.







## Storerooms are filling with looted artifacts intercepted by customs agents around the world. More than four tons of loot sit in a warehouse in London's Heathrow Airport awaiting repatriation.

ivory and bone sculptures, more than a thousand in all, featuring placidly smiling women and mythical river creatures associated with the art of India.

Someone left this impossibly eclectic mix inside two rooms that, around A.D. 200, were bricked shut and abandoned. Dazzled by the find, archaeologists compared it to the discovery of King Tut's tomb 15 years earlier, believing it to be the remains of a royal residence. Researchers now think the structure may have been a warehouse for luxury goods being transported across Asia on the Silk Road or marketed to local elites.

Like Begram, the site of Tillya Tepe ("golden hill") in Afghanistan's northwestern corner yielded treasures—most famously the Bactrian gold—whose legend was only heightened when they disappeared from view. Found by Russian archaeologist Viktor Sarianidi in the 1970s, the hoard tells a uniquely Afghan story of how nomads rode off the Central Asian steppes around the time of Christ, crossed the Amu Darya River, and created a civilization whose art reflects an amalgam of East and West, transience and settled life. From the wilds of Siberia come the animals, such as a bear depicted on a knife handle, dancing and holding a grapevine in its mouth. Greek and Hindu influences merge in a golden Aphrodite with wings and an Indian-style circle on her forehead.

Many objects show a strikingly Western naturalism, such as a ram sculpted in gold that decorated a nomad nobleman's headdress. Only under a magnifying glass can the masterpiece's splendid workmanship be fully appreciated. And

a delicate, golden crown tells of a refined culture that had not given up its steppes roots. The crown can be disassembled into six pieces for easy transport, perhaps in a leather satchel on a two-humped Bactrian camel—a perfect accessory for a nomadic princess.

ARCHAEOLOGY IS SLOWLY returning to Afghanistan, promising more discoveries and deeper knowledge. New sites are being excavated, and well-known ones are being mapped for reexploration. In the past, American or European researchers played key roles; these days, Afghan archaeologists often lead projects on their own.

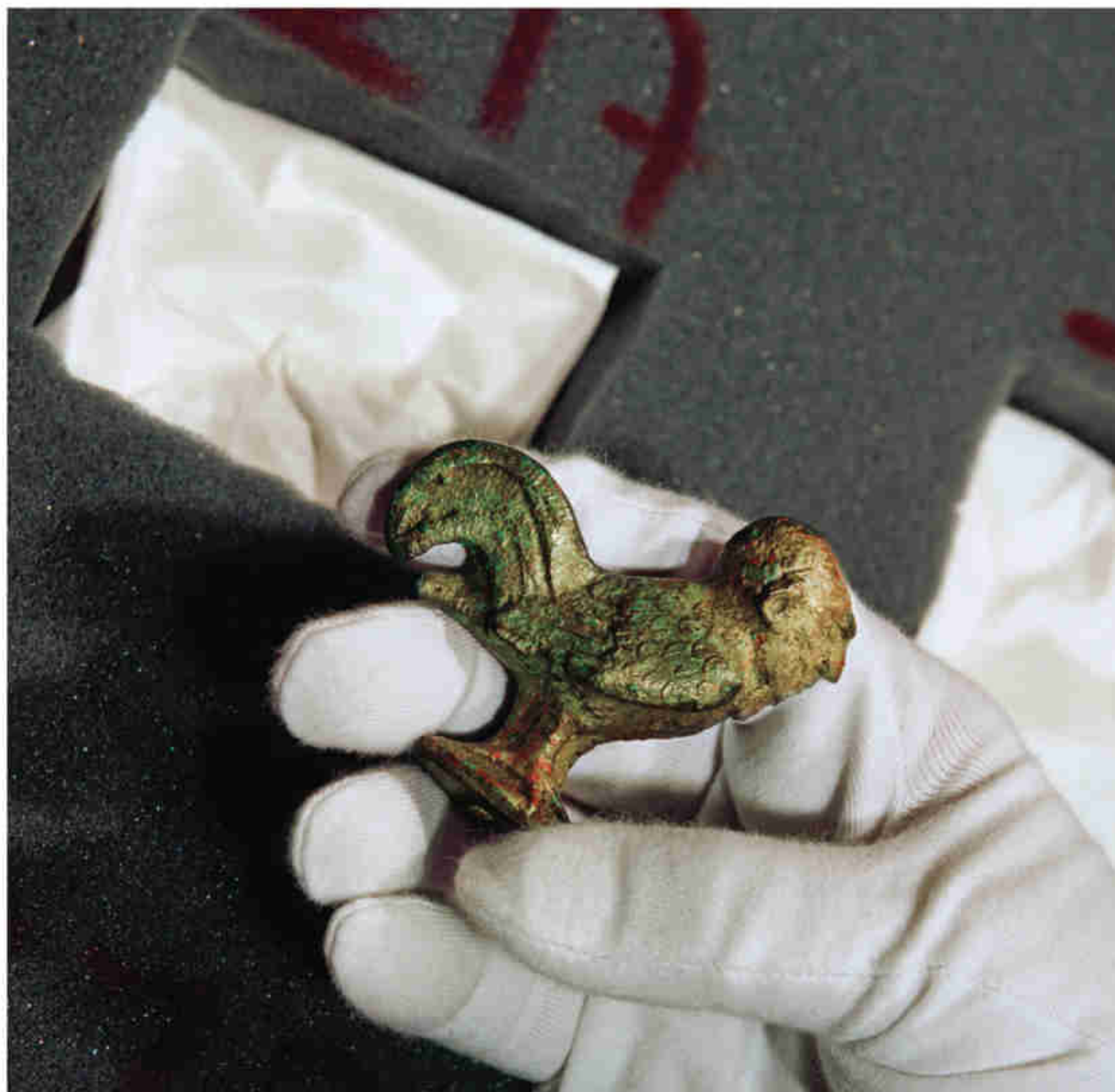
On a steep hillside outside Kabul, at a well-preserved Buddhist site from about A.D. 400 called Tepe Maranjan, Afghan researchers found the remains of 16 clay bodhisattvas arranged in a circle. Only their feet and the bottom of their robes were intact, and the Buddha statue they'd once surrounded was gone, probably demolished in the first Islamic invasions a few centuries later. Also gone, except for its bare feet, was a 20-foot-tall upright Buddha that had towered over the site, beckoning the monks to prayer. Perched on an arid hilltop, overlooking the plains where today the city of Kabul stands, the site gives a rich sense of the Buddhist ideals of quiet contemplation and remove.

"If this had been discovered during the Taliban's day, it might well have been destroyed," says archaeologist Najib Sedeqi. A few guards keep a close eye on the site with cooperation from neighbors.

Every period in the country's history is opening up to exploration. Afghan and French archaeologists will soon start excavating one of the oldest known mosques in Afghanistan, the No Gonbad ("nine domes"), which stands outside Balkh amid fields of flourishing marijuana plants. With its mighty columns and thick walls, now half-buried in soil and debris, the mosque expresses power and permanence. When Islam came to Afghanistan, it clearly came to stay.

Despite the progress, huge challenges remain. Crime, looting, and the threat posed by Taliban





Mystery in bronze: Carefully packed for travel between exhibitions, a human-headed rooster figure puzzles experts. Was it a weight used on merchants' scales? What does the figure represent? Investigating such questions has been impossible in the decades of violence that have wracked Afghanistan.

insurgents could snuff out Afghanistan's nascent cultural revival at any moment. At Tillya Tepe villagers looking for antiquities and building material have practically leveled the "golden hill." At Ai Khanum, where Alexander the Great built a city on the banks of the Amu Darya, archaeologists found baths, Hellenic lettering, and other traces of an outpost of Greek culture on the doorstep of China. Since then, unemployed fighters for local warlords have started to pillage the site, turning it into a lunar landscape of pits and tunnels. At Begram, looters who were once moonlight scavengers have become bolder and better equipped.

"We were patrolling the site one evening when we heard a gunshot, and then I realized

that we were the target," said Aynadin Sodeqi, the mustachioed commander of the Begram unit of a new police force charged with protecting Afghan archaeological sites.

He and his men had stumbled upon a group of looters who were digging treasures to sell in the antiquities trade. The looters escaped, but Sodeqi and his men found at least part of their stash: 28 ancient coins and a stone tablet decorated with lotus flowers. Sodeqi also found a piece of equipment that the looters presumably planned to use that evening. What kind of equipment? He answered with a pantomime, holding out his fists and vibrating them up and down: a jackhammer.

"The looters know the value of the things





Exquisitely detailed and impeccably preserved, this golden ram once crowned a nomad's headdress. Its survival is cause for celebration—and a tribute to those who kept it safe through perilous times.



they pillage,” says Nadir Rassouli, director of the Afghan government’s Institute of Archaeology, which has final authority over the country’s 1,500-plus known ancient sites. “They are armed, and no matter how many officers we place at sites, they attack them and drive them off. Then they loot.”

At Rassouli’s prodding, the Afghan government created the archaeology police force in 2004, starting with about 200 men. It has grown to 500, but Rassouli says it would take many times that number to cover the entire country. Most lack training and weapons. The first sustained attack on the new force came in August 2006 at the legendary Silk Road outpost of Balkh, whose towering walls protect the remains of millennia of history. Four officers were killed by antiquities hunters in that incident, and at least six more have since been murdered in the line of duty.

Tons of Afghan loot are believed to be circulating globally. Coins have a particularly avid market, and Begram has long been known for huge caches embedded in its soil, attesting to its role as a major trading point in antiquity. A British traveler in 1833 reported that local people dug up 30,000 coins every year. He carried off 2,000 for himself.

Today it is land mines that stud Begram’s fields, as members of Sodeqi’s police unit know. Among protruding sherds of Kushan-era pottery, lines of red stones mark the dangers; a closer look reveals innocent-looking plastic disks lurking in the grass like discarded toys. Such is the poverty and desperation—and such are the profits to be gained from antiquities—that not even land mines deter looters.

LAND MINES, a resurgent Taliban, suicide bombs, the searing memory of war—the obstacles bedeviling Afghans as they try to put their country back together are daunting. “The biggest thing that’s broken in Afghanistan isn’t the buildings, or the roads, or even the electrical system. It’s the broken psychology,” says curator Hiebert. “Twenty-five years of war is hell. Not only were tons of artifacts stolen, so was

“Twenty-five years of war is hell. Not only were tons of artifacts stolen, so was the Afghans’ history, their heritage. How can they get their pride back?”

—Fredrik Hiebert  
EXHIBITION CURATOR

the Afghans’ history, their heritage. Afghan children no longer know Afghan folk songs. How can they get their pride back?”

There are many answers to that question. One is on view in Kabul, where an Afghan national treasure is receiving a makeover. In the early 1500s, the Mogul emperor and famed memoirist Babur laid out a 20-acre garden on a hillside and planted it with his favorite trees. Babur’s garden had become an overgrown lot by the time the Aga Khan Trust for Culture began restoring it a few years ago. It is now Kabul’s finest public space and a glowing symbol of the tentative, post-Taliban cultural flowering.

At the top of the garden stands Babur’s restored white-marble tomb. Not far away, builders have erected a full-scale reproduction of a caravansary, a lodge where Silk Road caravans would spend the night, on precisely the spot where one stood in Babur’s day. The day I visited, the caravansary’s big courtyard echoed with the sparse, haunting sounds of a traditional stringed instrument known as the sarinda.

The man playing it, Kaka Qader, may be one of the few sarinda masters still alive in Afghanistan. But he won’t be the last: A bright-eyed music student watched transfixed as the master played. Then the young man took the instrument, a tabla drummer joined in, and the courtyard resonated with the hopeful sound of a new generation of Afghans playing their music. □

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📌 **Treasures on Tour** The National Geographic exhibition will appear in museums in Washington, D.C., San Francisco, Houston, and New York. For venues and dates, visit [ngm.com](http://ngm.com).



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A predator-proofed corral in Ladakh keeps livestock safe from snow leopard attacks.

**SNOW LEOPARDS, PAGE 106** **Save the Cats** Covering traditional stone corrals with chain-link fencing (above) protects Himalayan herders' livestock from snow leopards. It also protects snow leopards from the herders themselves. Minimizing livestock losses cuts down on revenge killings of the big cats. Says Darla Hillard of the Snow Leopard Conservancy, which helps fund the predator-proofing, "Our basic approach is to turn the snow leopard from being seen as a pest into a valued asset, worth more alive than dead." The following groups work with Central Asian communities to help both the people who live there and the cats.

■ **Snow Leopard Conservancy** forms partnerships with in-country groups to foster stewardship of snow leopards and their habitat. Efforts include camera traps and tracking with GPS units as well as programs to benefit local people, such as *himalayan-homestays.com*. For more information, go to [snowleopardconservancy.org](http://snowleopardconservancy.org).

■ **Snow Leopard Trust** offers an array of conservation programs in five different countries: livestock vaccinations in Pakistan, livestock insurance in India, ecotourism in Kyrgyzstan, and more. Crafts made by Mongolian herder families can be purchased from the trust's Snow Leopard Enterprises at [snowleopard.org/shop](http://snowleopard.org/shop).



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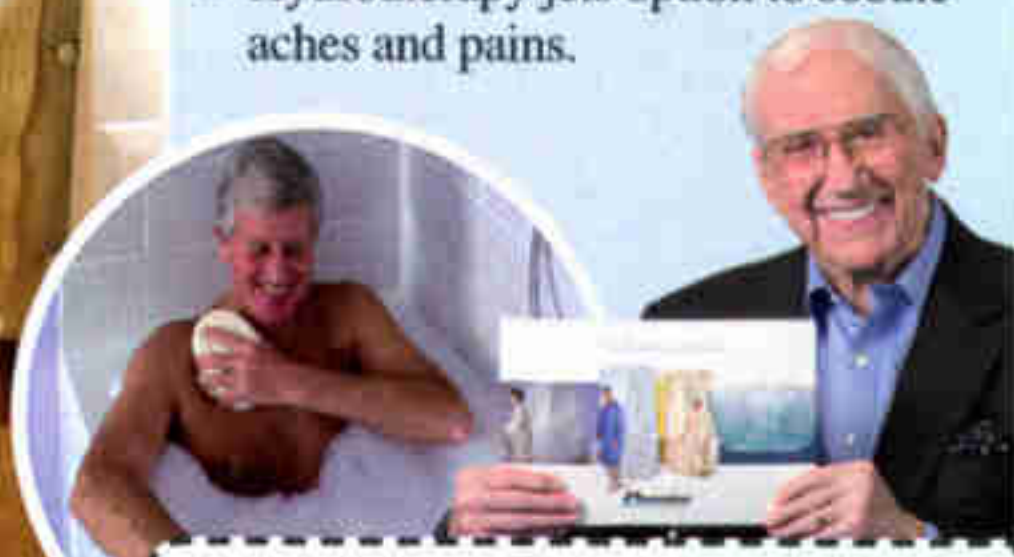
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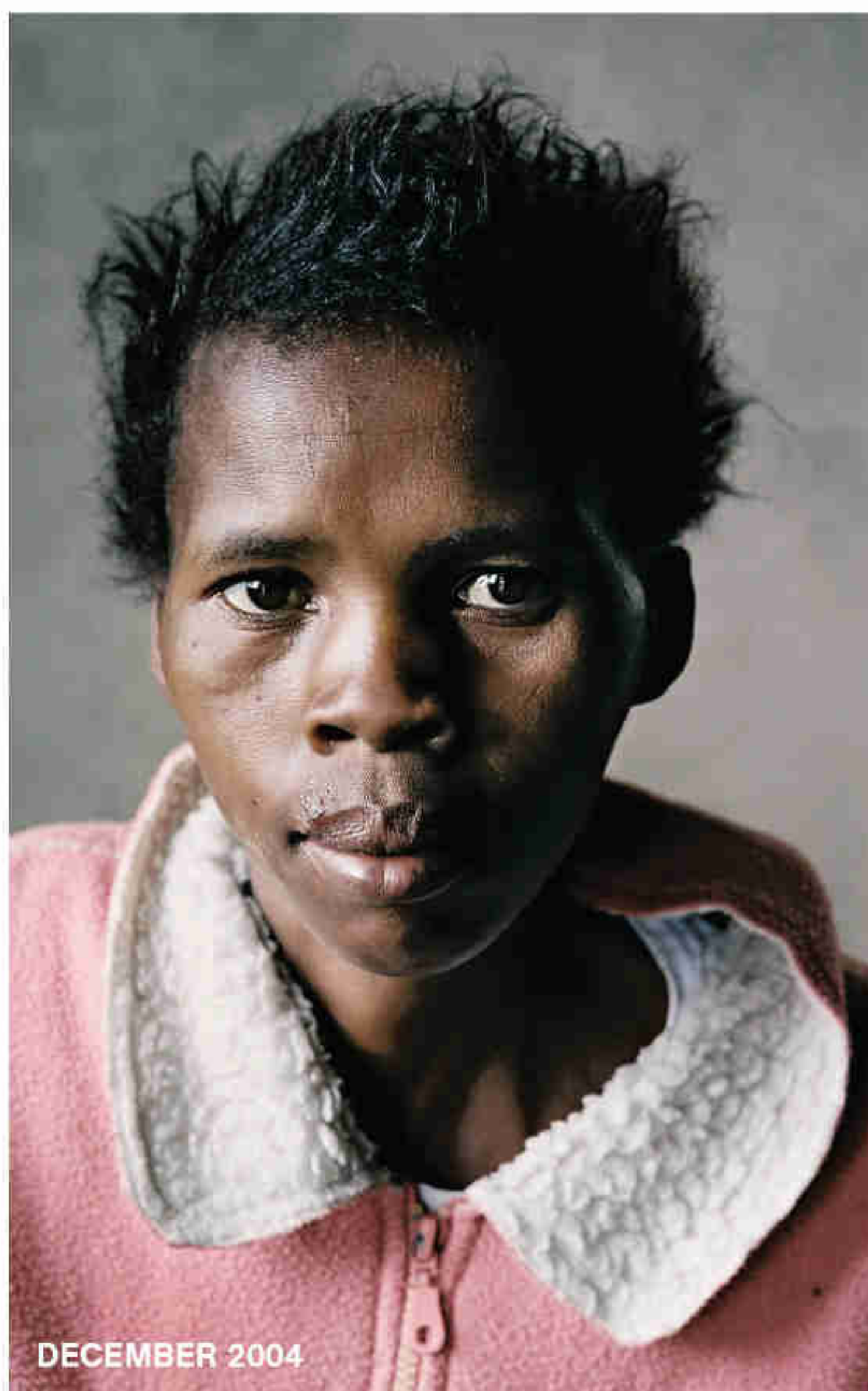
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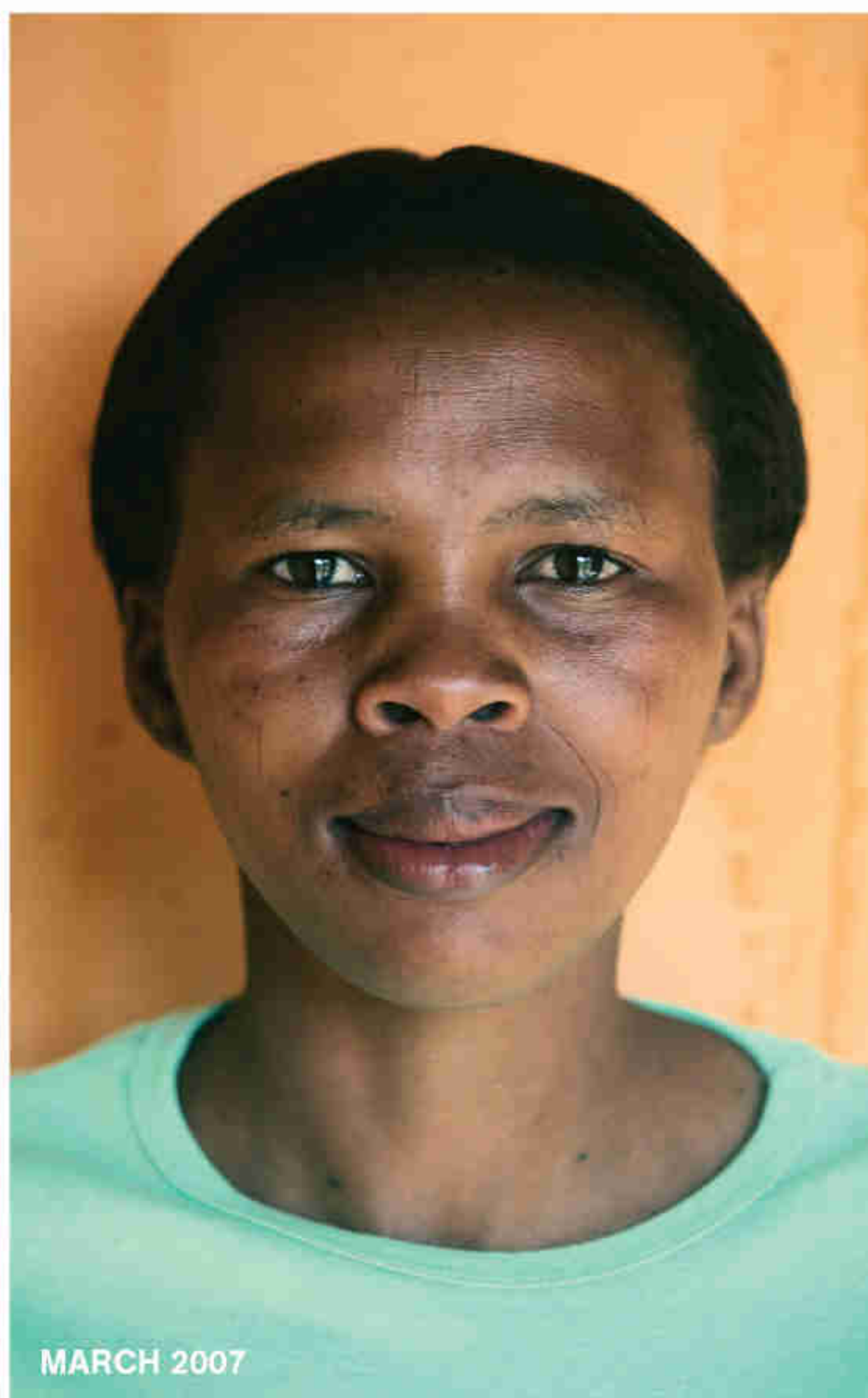
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MARCH 2007

Nompilo Mazuza, now 31, before and after treatment for AIDS and multi-drug-resistant tuberculosis.

**UPDATE Living With AIDS** Nompilo Mazuza (above) was not well when photographer Gideon Mendel first met her in Lusikisiki, South Africa. Her CD4 count, a measure of the immune system, was seven; a count below 200 signals AIDS. She had just started receiving free antiretroviral drugs from a program that Mendel wrote about in the September 2005 *Geographic*. As heard on a multimedia feature from that time on *ngm.com*, Mazuza sounds breathy and exhausted. She says she hopes the antiretroviral drugs will help her. But she also had multi-drug-resistant tuberculosis, which kills many people with AIDS in Africa, and her future was uncertain.

After three years of treatment, Mazuza's CD4 count is 291, and she is TB free. In 2004 a visit to the clinic exhausted her. Now, "I am doing household work, like cleaning the house and fetching water from the river," she says. She would like to start a small business at home, maybe sewing. Most of all, she wants others to look at her and see the power of antiretroviral drugs. She's getting that wish: On a recent clinic visit, she brought a young neighbor with HIV who had seen her get better and hoped the doctors could help him too.



# **If you have a credit card, paid by check for an online or phone purchase, got cash at a casino, or had a bounced/returned check, you could get benefits from a data theft settlement.**

*Para una notificación en Español, llamar o visitar nuestro website.*

A settlement has been reached with Certegy Check Services, Inc. ("Certegy") and Fidelity National Information Services, Inc. (together called "Certegy") about the theft of personal and financial information in their consumer databases. The settlement includes a variety of benefits for consumers who had their personal or financial information stolen.

The United States District Court for the Middle District of Florida will have a hearing to decide whether to give final approval to the settlement, so that the benefits can be issued. Those included have legal rights and options, such as excluding themselves from, or objecting to, the settlement. Eligible people can submit a claim for benefits from the settlement. Get a detailed notice at [www.DataSettlement.com](http://www.DataSettlement.com).

## **WHAT IS THIS ABOUT?**

It was learned that a senior database administrator employed by Certegy, stole confidential information of millions of consumers from Certegy's records and sold them to a third party for marketing purposes. Certegy fired the employee when the theft was discovered. The stolen records included identifying information and, in some instances, checking account numbers, credit/debit card numbers and/or dates of birth. No social security numbers or driver's license numbers were stolen. The lawsuit alleges that Certegy did not adequately protect confidential personal and financial information. The settlement does not mean Certegy violated any laws or did anything wrong. Certegy denies any claims of wrongdoing in this case.

## **WHO IS INCLUDED?**

The Class includes everyone in the United States and Puerto Rico whose credit card, debit card, checking or demand deposit account numbers or information was included in multiple databases. This includes those who were previously notified by their financial institution or Certegy that their personal or financial information was stolen. Go to [www.DataSettlement.com](http://www.DataSettlement.com) or call 1-877-580-9770 to find out if you are in the database.

If you are included, you should remain vigilant by reviewing account statements and monitoring free credit reports. If you notice any unauthorized activity, promptly contact your financial institution. You can receive a free credit report at [www.annualcreditreport.com](http://www.annualcreditreport.com) or by calling 1-877-322-8228.

## **WHAT DOES THE SETTLEMENT PROVIDE?**

All Class Members who had their personal or financial information stolen can get compensated up to \$20,000 for certain unreimbursed identity theft losses, caused by the data

theft, which occurred from August 24, 1998 to December 31, 2010. If you were previously mailed a letter or notice of this incident you are also eligible for credit monitoring or bank monitoring performed by Certegy, identity theft insurance, and reimbursement for certain out-of-pocket expenses. The benefits available to you depend on the type of information that was stolen. If your credit or debit card account information was stolen you are eligible to receive one year of credit monitoring and \$10,000 in identity theft insurance and reimbursements for identity theft and certain out-of-pocket expenses. Identity theft insurance is not available in New York. If you had your checking or demand deposit account information stolen, you are eligible to receive two years of bank monitoring performed by Certegy and reimbursements for identity theft and certain out-of-pocket expenses. Certegy will pay up to a total of \$4 million to reimburse identity theft claims and up to a total of \$1 million for reimbursement of out-of-pocket expenses. Claims will be paid on a first-come, first-serve basis. A settlement agreement, available at [www.DataSettlement.com](http://www.DataSettlement.com), describes all of the details about the proposed settlement.

## **HOW DO YOU ASK FOR BENEFITS?**

Eligible Class Members can call 1-877-580-9770 or go to the website for a claim form, then fill it out, sign it, include the documentation it requires, and mail it to the address on the form. Please note that there are different deadlines for different benefits. The earliest deadline for benefits is **July 31, 2008**.

## **YOUR OTHER OPTIONS.**

If you do not want to be legally bound by the settlement, you must exclude yourself by **August 1, 2008**, or you will not be able to sue, or continue to sue, Certegy about the legal claims this settlement resolves, ever again. If you exclude yourself, you cannot get any benefits from the settlement. If you stay in the Class, you may object to it by **August 1, 2008**. The detailed notice explains how to exclude yourself or object.

The Court will hold a hearing in the case, known as *Lockwood v. Certegy Check Services, Inc.*, No 8:07-cv-1434-T-23TGW, on **August 22, 2008**, to consider whether to approve the settlement, and a request by Class Counsel for attorneys' fees, costs, and expenses of up to \$4.3 million. Class Counsel will also request payments up to \$500 as an incentive award for the Plaintiffs who helped the lawyers on behalf of the whole Class. These payments are separate from the other benefits to Class Members and will not reduce those benefits. You or your own lawyer may ask to appear and speak at the hearing at your own cost, but you do not have to. For more information, go to the website shown below.





Ken Geiger (above) wields a flashlight. Archaeologist Mike Parker Pearson (below) excavates a wall.

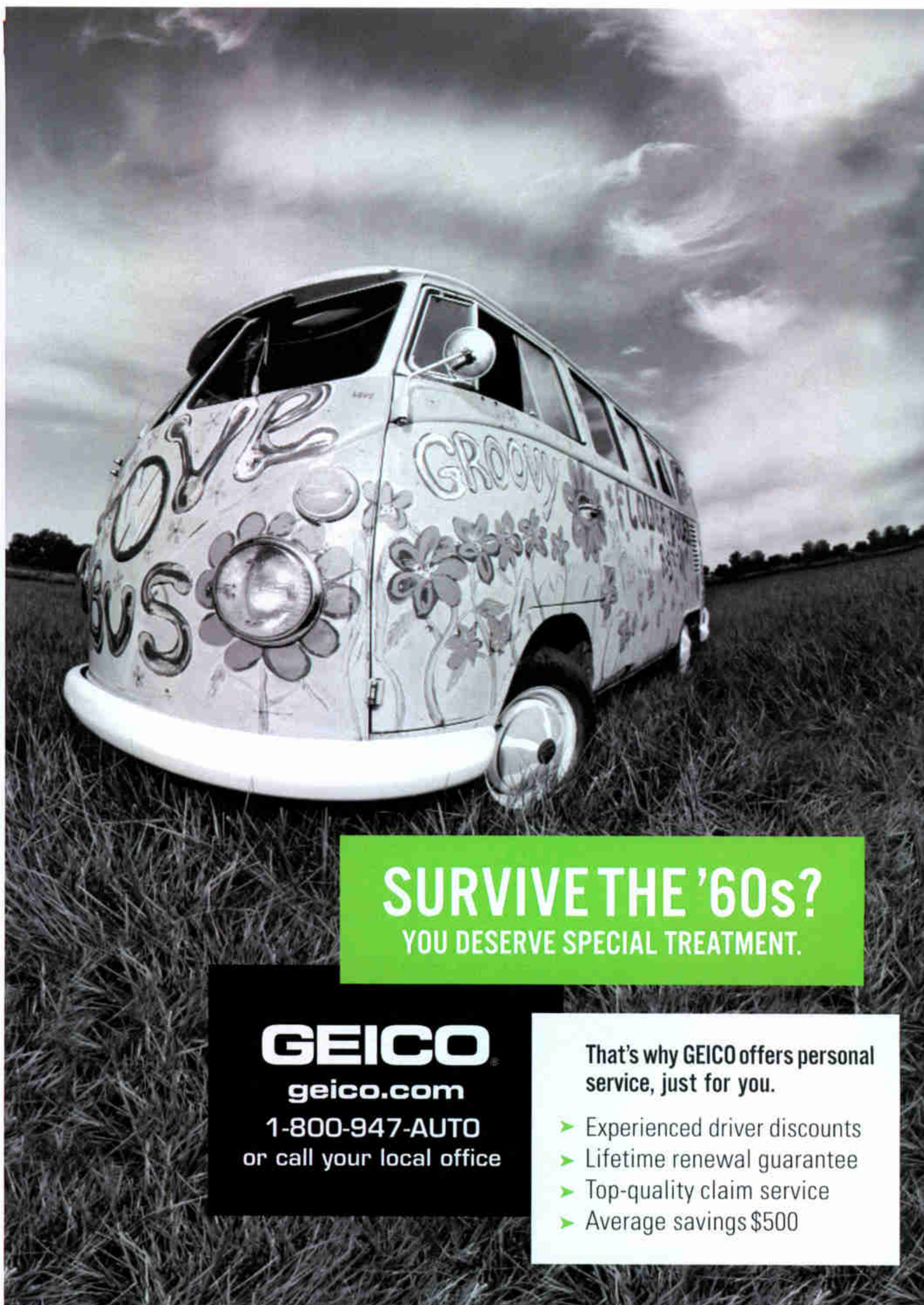
**ON ASSIGNMENT Stonehenge Nights** Before senior editor Ken Geiger set out to take pictures of Stonehenge, he knew it would be a challenge to find a fresh way to capture the well-documented site. His solution started with a technique known as light painting. English Heritage granted special access for his all-night photo shoots, which were timed to coincide with the full moon. Dressed entirely in black so as not to become part of the image, Geiger opened the camera's shutter for about 15 minutes and—like a graffiti artist but with a high-intensity flashlight—stopped at each stone to paint it with light. Steady winds on the Salisbury Plain

caused drifting clouds to blur, creating shapes and patterns that Geiger never saw until each digital exposure had finished processing. "Every time you shoot," he says, "it's a surprise."

The National Geographic Channel is airing *Stonehenge Decoded* on June 1 at 9 p.m. ET/PT. This new program uses graphics and reenactments to present the ideas Society grantee Mike Parker Pearson has about how Stonehenge might once have been used. And at [ngm.com](http://ngm.com) readers can explore a three-dimensional photographic model of the megaliths.







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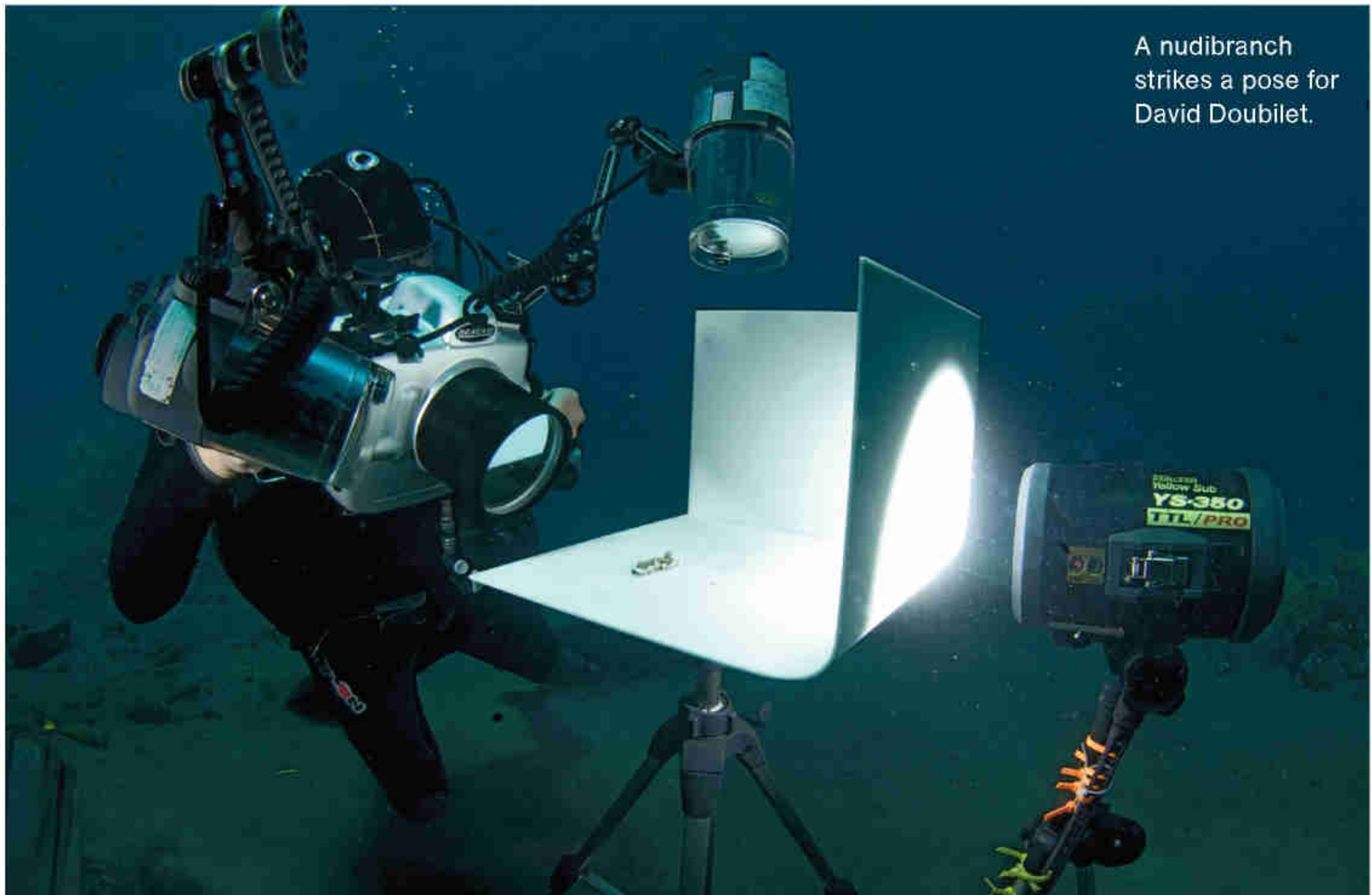
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A nudibranch strikes a pose for David Doubilet.

**ON ASSIGNMENT Slug Show** Many of the nudibranchs on pages 92-105 were photographed right where David Doubilet found them. But some strutted their stuff in a custom-made white mini-studio. Doubilet's idea was to illustrate the nudibranchs' wild colors by separating them from their environment. He set up his gear next to a nudibranch he wanted to photograph, then gently placed it in the studio. "I tried to shoot them like fashion models," he says. All the "models" were returned unharmed.



Bitter cold doesn't stop these crewmen—or photographer Gerd Ludwig (center)—from getting down to work on a Siberian oil rig.

## ON ASSIGNMENT Rigged Up

Photographer Gerd Ludwig was careful where he stood when shooting on rigs for the Siberian oil story. "The work area is fairly small, and you are in people's way all the time," he says. "Often your ideal position blocks their views." Drilling is monotonous and dirty work, and the drill rig is open to the cold sky. Workers spend up to 30 days on the oil pad, miles from the next rig and far from home. But the pay they get is good, says Ludwig—and so is the food.



# If You Own a Home or Other Structure with Polybutylene Plumbing

## You May Have a Claim to Receive Benefits in a Class Action Settlement.

You may be eligible to receive benefits from a Settlement approved by the Chancery Court for Obion County, Tennessee. The case is entitled *Cox v. Shell Oil Company*. The \$1.103 billion Settlement of the class action lawsuit was entered on November 17, 1995. The lawsuit was brought on behalf of homeowners with polybutylene plumbing (PB pipe). Eligible homeowners could receive a free replacement of their PB pipe.

**To get complete information you should visit [www.pbpipe.com](http://www.pbpipe.com) or call 1-800-392-7591.**

### Who is Eligible?

You could be eligible for relief if you own a home with PB pipe that has insert fittings. The PB pipe must have been installed between January 1, 1978 and July 31, 1995. If your PB pipe has leaked in the past or leaks in the future, you may be entitled to benefits.

### What Does the Settlement Provide?

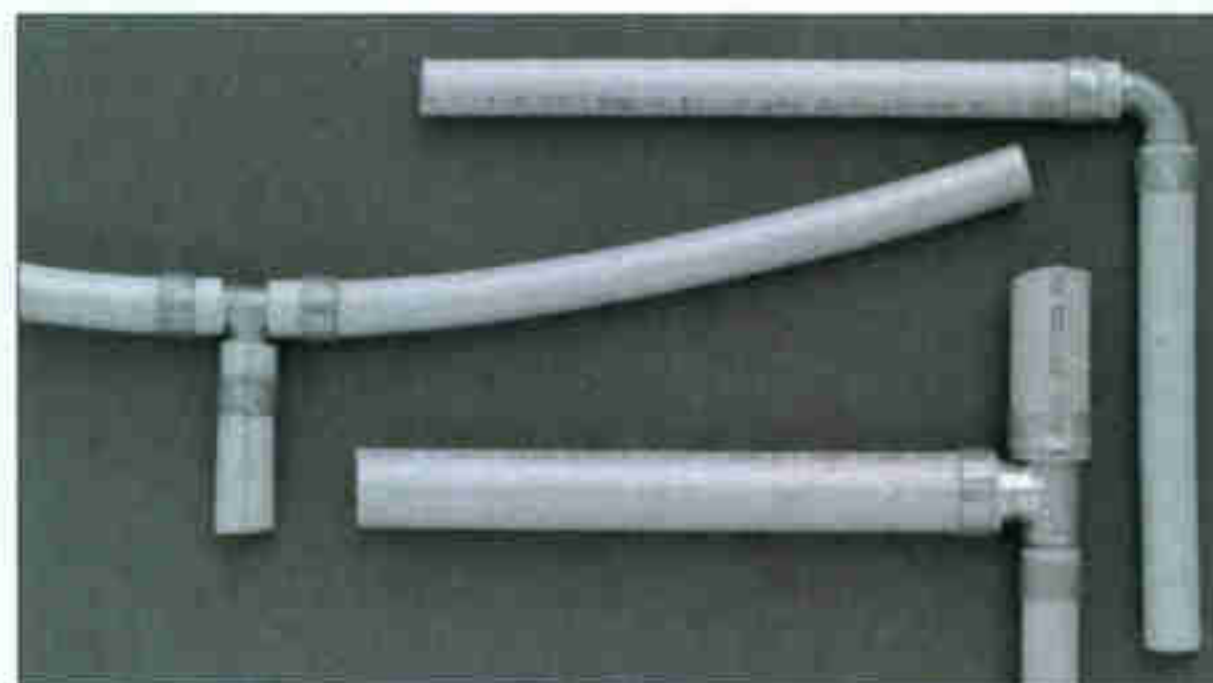
The Settlement provides a free replacement of the PB pipe and compensation for damage to property of homeowners with qualifying leaks. If your home has PB pipe, please visit the Web site or call the toll-free number below to get complete information on eligibility, filing a claim and deadlines. You must complete a Claim Eligibility Form to qualify for relief.

### The Right to Exclude Yourself

If you purchased your home after **September 12, 2005**, you may have the right to exclude yourself from the Class. If you exclude yourself, you will not receive any Settlement benefits and you will not be bound by the terms of the Settlement. To exclude yourself, you need to complete, sign and return an Exclusion Request by **September 1, 2008**. The home purchase date for exclusion may be different for some homeowners with PB pipe living in Alabama, Louisiana, Mississippi and Texas.\*

### Identifying PB Pipe

- PB pipe is used in water supply systems. It is a non-rigid, sometimes curved and usually gray plastic pipe.
- PB pipe is **NOT** used for drains, waste or vent piping.
- PB pipe is **NOT** PVC or CPVC, which is a rigid white or off-white plastic pipe.



**For more information on your rights under the Settlement, including the Notice of Class Action and Settlement, the Claim Eligibility Form and the Exclusion Request,**

Visit the PB Pipe Web site

**[www.pbpipe.com](http://www.pbpipe.com)**

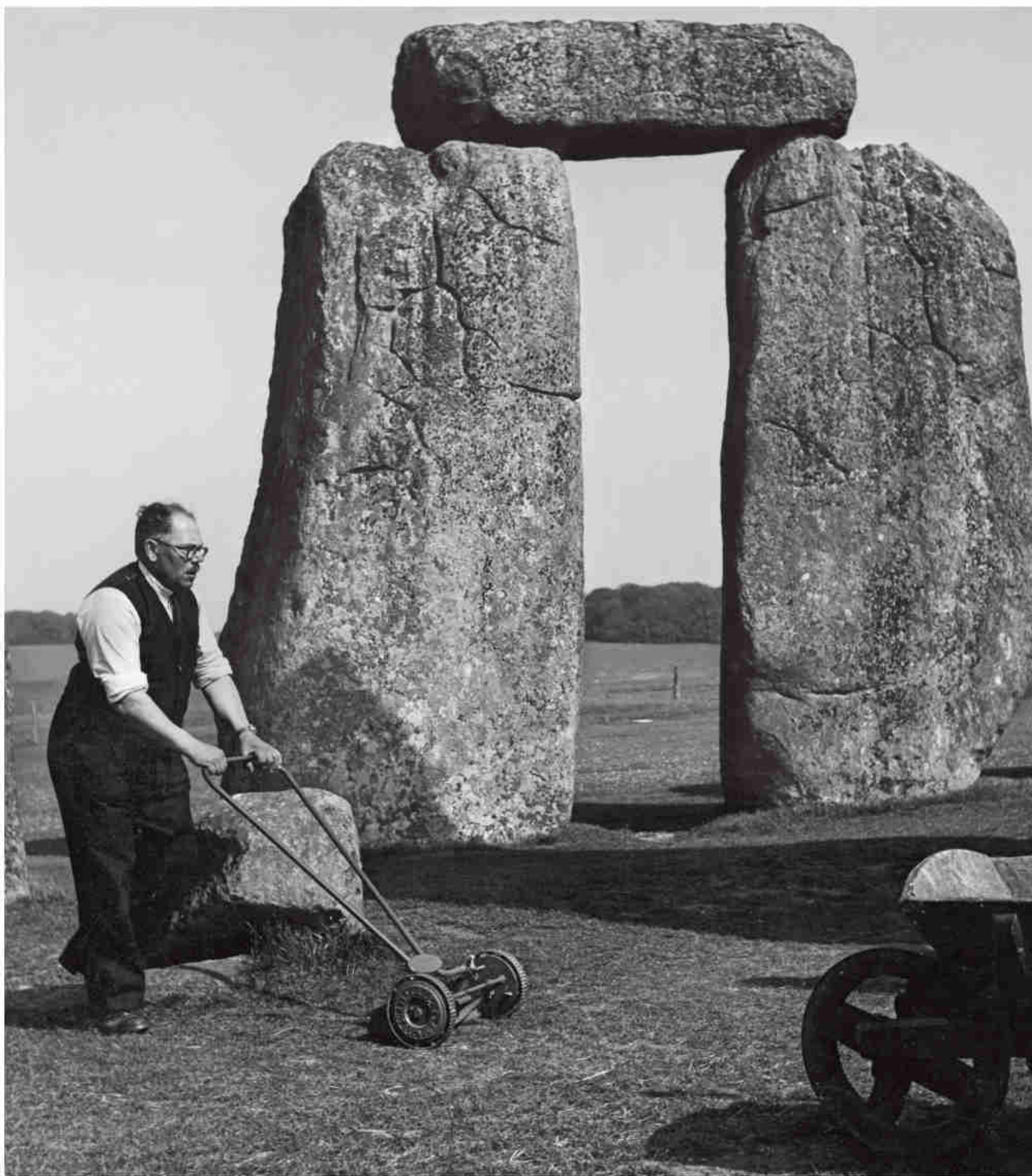
Call the Toll-Free Telephone Number

**1-800-392-7591**

Or write to: Consumer Plumbing Recovery Center,  
PO Box 869006, Plano, TX 75086-9006

\*Homeowners living in certain counties in the Gulf Coast area that were affected by Hurricanes Katrina and Rita can exclude themselves if their home was purchased after August 12, 2002. To see if your county is included, please visit the Web site or call the toll-free number.





**Cutting It Close** Mowing among the megaliths at Stonehenge must have been a mighty task. England's Salisbury Plain—home to the famous standing stones as well as hundreds of other prehistoric sites—is one of the largest expanses of rare chalk grassland left in Europe. The man in this 1950s photograph (never previously published in the *Geographic*) was unavailable for comment on his labors. His name did not accompany the image, and his origins, much like Stonehenge's, remain a mystery. —Margaret G. Zackowitz

🐭 **Flashback Archive** Find all the photos at [ngm.com](https://ngm.com).

PHOTO: BARBARA MADDRELL, NG IMAGE COLLECTION

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## AARP: Founded on the simple premise that no one should have to live in a chicken coop.

In 1947 on a meager pension, it was all one retired teacher could afford.

That's when Dr. Ethel Percy Andrus, a retired high school principal, made a shocking discovery. On a visit to a former teacher, she found the woman living in an old chicken coop, in poor health and unable to afford medical care.

Ethel got mad. She also got organized. After helping that first teacher, she turned her efforts to helping others with a campaign to obtain affordable health insurance for retired teachers. Over 40 companies turned her down, but she persevered and eventually succeeded. She soon discovered that many other older people needed help as well, and in 1958, she founded AARP.

Today as the nation's leading membership organization — nearly 40 million strong — AARP remains committed to championing the needs of our members and the future of every generation.

We do this by focusing on the five things every generation shares:

- The need for health
- The need for financial security
- The need for community
- The need to give back to society
- The need to enjoy life

Meeting these needs and ensuring the quality of life for all as we age is no small task. It requires a unique three-part organization.

AARP, the parent, is a strong nonprofit, nonpartisan advocate for consumer rights and provides trusted information with our publications, voter education guides, research and a website that cover the issues our members care about most.

The AARP Foundation is our charitable arm. It provides services to both members and nonmembers — especially the most vulnerable in society. Our Foundation delivers direct services such as the nation's largest free, volunteer-run tax assistance program and legal advocacy work to support the rights of older people across the country.

Finally, AARP Services, Inc. makes available products and services designed specifically for the 50+ consumer — many of whom might otherwise be excluded from the market. We do this by working with leading businesses to identify and respond to the ever-changing needs of Americans as they age. These relationships not only help shape the marketplace, but also earn revenue that helps AARP achieve its mission of leading positive social change and delivering value to members.

When she founded AARP 50 years ago, Ethel proclaimed that “an army of useful citizens” can do what no one person can. Today we at AARP champion her dream and serve all generations through vigorous action and by never forgetting the one act of compassion that started it all.

Learn more about AARP's history and our continuing mission at [aarp.org/champion](http://aarp.org/champion).

